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The effects of government interventions in the financial sector on banking competition and the evolution of zombie banks

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The Effects of Government Interventions in the Financial Sector on Banking Competition and the Evolution of Zombie Banks

Abstract

We investigate how government interventions such as blanket guarantees, liquidity support, recapitalizations, and nationalizations affect banking competition. This issue is critical for stability, access to finance, and economic growth. Exploiting cross-country and cross-time variation in the timing of interventions and accounting for their non-randomness, we document that liquidity support, recapitalizations, and nationalizations trigger large increases in competition. We also find some more nuanced evidence that zombie banks' market shares in crisis countries evolve together with interventions. A higher frequency of interventions coincides with greater zombie bank presence, and increases in competition are larger when zombie banks occupy bigger market shares.

Keywords: bank bailouts; government interventions; competition; zombie banks; loan and deposit rates

JEL Classification: G21, G28

"Rescuing large banks may have averted the immediate crisis, but it also provided these banks a competitive advantage, [...] potentially destabilizing the financial system."
Final Report of the Congressional Oversight Panel (16th March 2011, p. 189)

"the measures [...] ensure a sustainable future for Lloyds without continued state support and that there will not be undue distortions of competition."
European Commission - Press Release IP/09/1728 (18th November 2009)

I. Introduction

Banking systems have been profoundly reshaped by crises and the concomitant policy responses. In recent years, governments and other authorities designated with banking regulation and supervision issued blanket guarantees, extended liquidity support, injected capital, and nationalized banks on an unprecedented scale (Hoshi and Kashyap (2010); Bayazitova and Shivdasani (2012); Duchin and Sosyura (2014)). Such government interventions affect large numbers of institutions because these interventions send strong signals to all banks in the market, and make them anticipate future bailouts. This distorts their incentives with potential implications for competition (Acharya and Yorulmazer (2007)). Moreover, interventions can undermine the Schumpeterian process of creative destruction. Weak banks may not exit the market and evolve as unviable zombie banks, i.e. banks that have an economic net worth below zero but continue to operate and remain able to repay debt because of government support. In turn, these zombie banks may crowd out their healthy competitors (Claessens (2009a)).

In this paper, we contribute to the debate about the unintended effects of government aid for the banking sector using a large dataset for 124 countries, 41 of them experienced banking crises between 1996 and 2010. While the recent crisis has shown that interventions can have stabilizing effects, we ask what the effects are of blanket guarantees, liquidity support, recapitalizations, and nationalizations on banking competition during crises. We also investigate how these interventions correlate with the evolution of zombie banks, and our final tests document how interventions and zombie banks affect deposit and

loan rates. Although the literature started examining the effects of interventions on risk-taking at the bank level and distinguishes between the behavior of rescued banks and their competitors, no effort has been devoted to the effects on competition for the entire industry, despite the relevance for policy and regulation. Therefore, we perform our tests on the aggregate level of the banking system, i.e., on the country level, to take the signalling effects for all banks into account.

A common feature that connects the four interventions we study is that they supplant market discipline on the liability side and constitute a source of moral hazard on the asset side of banks' balance sheet. Since theoretical work and empirical evidence offer so far no insight into the effect of government interventions on competition on the banking system level, we turn to several studies on the bank level, and the literature on the interaction between non-financial firms' leverage and product-market dynamics to obtain some indications for the effects of interest.

Focusing on blanket guarantees for individual banks, Hakenes and Schnabel (2010) and Acharya and Kulkarni (2013) show that blanket guarantees equip banks with competitive advantages in funding markets. Similarly, Richardson and Troost (2009) argue that liquidity support increases distressed banks' survival odds. Berger and Bouwman (2013) document that better capitalized banks also have higher survival odds during crises. Furthermore, they show that such banks expand market shares. On the other hand, Cordella and Yeyati (2003) predict that recapitalizations make banks less aggressive as capital support raises charter values. Moral hazard effects from guarantees are documented by Gropp, Gruendl, and Guettler (2014). Similarly, Freixas (1999) highlights that central bank liquidity support creates moral hazard, and Duchin and Sosyura (2014)

discuss moral hazard implications of recapitalizations. The literature on the link between non-financial firms' leverage and product-market dynamics offers conflicting views. Brander and Lewis (1986) predict firms with more debt prey on competitors, an argument which suggests that blanket guarantees increase competition. In contrast, Chevalier (1995) shows that less levered firms are more competitive. This suggests that recapitalizations and nationalizations should increase competition.

Given these inconclusive predictions and the lack of evidence, empirical work is necessary to establish the effects of government interventions on banking competition. However, in the absence of a natural experiment, it is challenging to identify causal effects with cross-country data. Before employing difference-in-difference estimations, we therefore first demonstrate that interventions are orthogonal with respect to competition, measured by Lerner indices and net interest margins. Moreover, we also show that treatment and control group countries satisfy the parallel trends assumption.

Our key results, unique in the literature, highlight large increases in competition from liquidity support, recapitalizations, and nationalizations. These effects tend to persist over time. We can rule out that compressed interest income during crises, and poor demand conditions drive our results.

Disentangling reactions to banking crises from the responses to interventions is another challenge. Crises may trigger similar effects for the outcomes we study, and in most instances the onset of crises coincides with the announcement of interventions. While our data do not permit comparing crisis countries with and without interventions because crisis countries also experience interventions, we show that the competition-increasing effects remain in place when we omit countries with systemic crises and constrain

treatment to those which experience borderline (i.e., non-systemic) crises. We also observe increases in competition once we drop countries that witnessed the most intensive crises, and EU countries where rescues have been conditional on pro-competitive restructurings. In addition, we run falsification tests based on relaxations of banks' activity restrictions and fake crises which also support our inferences.

Moreover, it is also challenging to separate the effects of the four direct types of government interventions we study from macroeconomic conditions and macroeconomic policies adopted during crises that may also affect the outcomes of interest. To alleviate such concerns, our regressions control for monetary policy conditions, governments' ability to bail out banks, and changes in the exchange rate.

The final challenge arises from the non-random assignment of interventions. Governments' actions to deal with crises are not only likely to be endogenous to the depth of crises but we also only observe interventions when crises actually occur. We deal with the former problem using instrumental variables, described in detail below. The latter problem gives rise to a selection problem which we address with a Heckman (1979) procedure, also discussed more specifically below. These tests reinforce the findings obtained with the difference-in-difference estimator.

What drives the shift towards more competition? Previous work suggests that government support suppresses the shakeout of unviable institutions, and these zombie banks prey on the healthy institutions' market shares (Kane (1990)). We advance this research to examine if zombie banks crowd out their competitors. In tests that focus only on crisis countries to better gauge the time-series evolution of zombie banks, we show that liquidity support and recapitalizations are positively associated with zombie banks' market

shares in deposit and loan markets when we rely on book values of equity to classify zombie banks. Recapitalizations and nationalizations are weakly positively associated with zombies' market shares when we use a market based measure of zombie banks. In addition, we show that large market shares held by zombie banks coincide with a greater frequency of interventions, and increases in competition tend to be greater when zombie banks are more prevalent.

Our last set of tests closes the loop and sheds light onto the effects of government interventions on average deposit and loan rates. Liquidity support, recapitalizations, and nationalizations depress deposit rates, but a detailed investigation suggests that this finding is not causally attributable to government interventions but rather driven by large degrees of government ownership of the banking system. On the other hand, however, borrowers benefit from reduced loan rates as a consequence of these interventions, and this finding obtains even after omitting countries whose banking systems are characterized by high degrees of government ownership of banks. As part of the analysis of pricing effects, we are also able to find more support for the role of zombie banks for aggregate shifts in market conduct. The pricing effects are more pronounced in a subsample of countries that have at least one year of zombie bank presence.

This research is important for three reasons. First, banking competition is assumed to be linked with financial stability, and this link dominates the policy debate and the architecture of regulatory frameworks (Claessens (2009b)). While it is beyond the scope of our study to examine effects of interventions on risk-taking, we stress that the risk-shifting effect arising from interventions for market discipline and moral hazard discussed in this literature also matters for our research. Typically, competition is seen as undesirable as it

incentivizes banks to take risk and increases the cost of government interventions. Second, banking competition affects availability of credit, access to finance, and, ultimately, economic growth (Claessens and Laeven (2005); Norden, Rosenboom, and Wang (2013)). To the extent that interventions affect banks' supply of credit via competition as shown in Giannetti and Simonov (2013), the competitive effects will spill over into the real economy. Third, academics and policy makers not only voiced concerns that the rescue measures affect competition as reflected in the quotes above, but the European Commission made it a policy objective to limit competitive effects as they believe rescued banks gain market power over their peers (Claessens (2009a)). For instance, the European Commission (2009) made state aid conditional on restructuring plans for supported institutions. These conditions include, *inter alia*, divestments of subsidiaries, branch networks, and limits on deposit pricing. Such conditions have been introduced in a few cases.[1]

Our research speaks to the literature on the design of bank bailouts. Aghion, Bolton, and Fries (1999) discuss closure rules and banks' incentives, and Gorton and Huang (2004) propose that government interventions improve welfare when private parties cannot provide liquidity. This view of a 'bright side' of interventions is also supported by Dwyer and Hasan (2007) who show that suspending convertibility reduces the number of bank failures. In contrast, Diamond and Rajan (2005) illustrate a 'dark side' of bailouts because they may trigger increased demand for liquidity and additional bank insolvencies.

We proceed as follows. Section II discusses the data, and Section III presents main results. Section IV examines the role of zombie banks. Section V documents pricing effects. Section VI concludes.

[1] See press releases by the European Commission (Royal Bank of Scotland, IP/09/1915; Lloyds Banking Group, IP/09/1728).

II. Data and overview about policy responses to banking crises

We use data for 124 countries, 41 of them experienced banking crises. The crisis data and the information about policy responses are obtained from Laeven and Valencia (2010, 2013) for 1996-2010. Of those crises, 29 are systemic, and 12 are borderline crises. A country is classified as having a systemic crisis if the banking system exhibited stress, reflected in significant runs, losses, and/or liquidations, and, additionally, if significant interventions can be observed. Countries that "almost met" the definition of a systemic crisis are classified as borderline crises. Interventions are considered significant if 3 of the following 6 events can be observed: (1) significant guarantees, (2) liquidity support (5% of deposits and liabilities to non-residents), (3) recapitalizations with public funds (exceeding 3% of GDP), (4) significant nationalizations, (5) significant asset purchases, and (6) deposit freezes or bank holidays.

Crises responses consist of an initial phase concerned with containing liquidity strain, protecting liabilities, and limiting fire sales. The containment phase triggers liquidity support, and guarantees on banks' liabilities, and, less frequently, deposit freezes and bank holidays. Subsequently, balance sheet restructuring takes center stage: banks are resolved, recapitalized, and nationalized. While deposit freezes and bank holidays have no prediction as to how they affect competition, other policy responses translate into precise predictions. We constrain our study to blanket guarantees, liquidity support, recapitalizations, and nationalizations because the literature offers indications for how these interventions affect competition.[2] Common to them is they provide signals to market participants about

[2] Theoretically, all interventions can be seen as combinations of liquidity infusions and recapitalizations. Diamond and Rajan (2005) show that a central authority which taxes claimants on liquidity and lends it back to the system at interest rates below those that taxpayers would choose increases supply of liquidity. When such a loan is at the

governments' commitment to rescue banks which raises expectations about future bailouts.[3] Table A.1 in the Supplementary Appendix, available at the journal website (www.jfqa.org) presents details.

Blanket guarantees. A common response to runs are blanket guarantees. They are defined as full protection of bank liabilities or instances in which non-deposit liabilities of banks are protected. Since runs destabilize payment systems, guarantees can restore confidence. Theory offers clear predictions for the effect of (asymmetric) guarantees. Kane and Klingebiel (2004) state that guarantees constitute credit enhancements which allow supported banks to obtain funds more cheaply. Subsequent work by Hakenes and Schnabel (2010) points out that guarantees not only affect protected banks but also their competitors. Guarantees reduce margins and charter values of the protected banks' competitors which arises from aggressive competition from supported banks that refinance at subsidized rates. This makes competitors more aggressive; a prediction confirmed by Gropp, Hakenes, and Schnabel (2011). Similarly, Acharya and Kulkarni (2013) show that guarantees yield competitive advantages for public sector banks in deposit markets, and Gropp, Gruendl, and Guettler (2014) show that guarantees supplant market discipline. They find removing guarantees curbs moral hazard. Work by Brander and Lewis (1995) examines the leverage of non-financial firms which is also relevant as

market rate, this operation is a pure liquidity infusion. In contrast, if the central authority relies on taxation power and allocates a gift of future value to a particular bank, e.g., a claim on goods in the future, such an operation is a pure recapitalization. Gifts of current goods to banks represent liquidity infusions equal to the quantity of current goods plus a recapitalization equal to the future value of those goods, evaluated at market rates.

[3] Unlike interventions during the containment phase, interventions in the resolution phase are observed on the bank level. We focus on industry effects and therefore analyze recapitalizations and nationalizations on the aggregate level to capture signalling effects. Table A.2 in the Supplementary Appendix presents complementary bank level evidence. Using a hand-collected sample of 589 recapitalizations and 26 nationalizations, we confirm competition-increasing effects of recapitalizations and nationalizations (except for nationalizations on net interest margins). To strengthen identification, we run these tests with bank fixed effects, year fixed effects, and also include specifications with an interaction of country fixed and year fixed effects. These tests purge time-invariant bank specific heterogeneities and time-varying effects and also any unobserved time-varying effect on the country level we may have omitted in our main regressions on the system level.

blanket guarantees increase bank debt. They find that highly levered firms behave more aggressively in the market.

Liquidity support also plays a role in containing crises. We consider instances of liquidity support when the ratio of central bank claims on the financial sector to deposits and foreign liabilities exceeds 5 percent and more than doubles relative to its pre-crisis level. We also consider liquidity support from the Treasury. The premise is that extending loans to troubled banks is less costly than no intervention. Richardson and Troost (2009) show that monetary intervention can be effective because emergency lending raises distressed banks' chance to survive. However, the increase in survival odds for supported banks provides them also with competitive advantages. Theoretical work in this area focuses on moral hazard. Freixas (1999) shows that the lender of last resort should not support all banks. However, when large banks (the too-big-to-fail phenomenon) or many banks (the too-many-to-fail phenomenon) are distressed, supporting the large bank or all distressed banks is the preferred action. Both the too-big-to-fail and the too-many-to-fail effect change incentives and give rise to moral hazard.

Recapitalizations. A cornerstone during the resolution phase is the provision of capital support. We define recapitalizations as instances in which the cost of recapitalizing banks exceed 3 percent of GDP. Beyond the moral hazard effect from recapitalizations documented by Dam and Koetter (2012) and Duchin and Sosyura (2014), several studies describe the link between capital and competition which provides insights for our work. While Allen, Carletti, and Marquez (2011) predict that higher capital ratios enable banks to compete effectively for loans and deposits and increase market shares, Cordella and Yeyati (2003) argue that recapitalizations reduce banks' propensity to compete because capital

injections increase charter values. Empirical work on capital structure yields conflicting results. On the one hand, Chevalier (1995) illustrates that less leverage increases non-financial firms' competitiveness. This result is confirmed by Berger and Bouwman (2013) who show that better capitalized banks have higher market shares. On the other hand, Lyandres (2006) shows that less levered non-financials compete less aggressively.

Nationalizations are takeovers of systemically important financial institutions and extend only to cases where governments take majority ownership stakes. In some crises, all banks are nationalized. Studies on government ownership suggest that state ownership allows banks to lend at lower loan rates relative to privately owned banks (Sapienza (2004)). This effect is attributed to reduced funding costs from government support (Acharya and Kulkarni (2013)). In turn, market discipline is undermined, reducing banks' monitoring incentives. This results also in moral hazard since nationalizations de facto guarantee bank debt. The predictions from the literature on non-financial firms discussed for recapitalizations also apply to nationalizations.

All interventions are related via the effects on refinancing costs and moral hazard. Thus, we first establish the overall effect on competition using Lerner indices and net interest margins. Importantly, while the market discipline effect operates on the liability side of the balance sheet, the moral hazard effect operates on the asset side. Consequently, we also document pricing effects for deposits and loans.

III. Effects of government interventions on banking competition

Various approaches exist to measure banking competition. We employ two alternative measures: the Lerner index, and the net interest margin. Both of them are widely used in the literature on banking competition (Claessens (2009b); Koetter, Kolari, and Spierdijk

(2012)). Since our tests are performed at the banking system level, we use the average Lerner index and the average net interest margin per country per year. We use 181,830 bank-year observations for 21,988 banks in 124 countries, obtained from BankScope, to compute the two competition measures. Further details are shown in our Supplementary Appendix A.3. BankScope is the limiting factor for the sample period.

The two measures of competition are complementary. The Lerner index captures market power by calculating the mark up of prices above marginal costs. This is important because Gropp, Hakenes, and Schnabel (2011) show that this is the main channel through which government subsidies affect banking competition. It includes non-interest income and non-interest costs, and consequently captures competition in broad activities. Moreover, the Lerner index has a solid theoretical foundation by relying on asset as well as funding information to capture the effect of pricing power on both the asset and funding side of the balance sheet (Anginer, Demirgüç-Kunt, and Zhu (2014)). In contrast, the net interest margin, calculated as the difference between banks' interest income and interest expenses and expressed in percent of earning assets, focuses on competition in traditional loan and deposit activities which dominate less developed banking systems. Since our data contain many emerging markets, relying on interest margins provides a sensitivity check. Unlike the Lerner index, the net interest margin can also easily be exploited to compute average loan and deposit rates which we study in Section V below. The two measures are not significantly correlated, the coefficient is -0.014. The average Lerner index is 0.25 and the average net interest margin is 0.06. These figures are comparable with previous work.

The key explanatory variables are coded as binary variables and take the value of one in the year the intervention was announced and subsequently if a country is still affected by

the intervention (Laeven and Valencia (2010, 2012, 2013)). We register 11 blanket guarantees. The dummy for liquidity support takes on the value one if liquidity support by the central bank is at least 5% of deposits and liabilities to non-residents/GDP (34 instances). Our dummy for recapitalizations is restricted to recapitalizations whose costs exceed 3% of GDP (32 instances). We code takeovers of systemically important banks and instances where the government takes a majority stake in banks' equity capital as nationalizations (26 instances).

A. Preliminary inspection

In a preliminary inspection, we demonstrate for each country which announced blanket guarantees, liquidity support, recapitalizations, and nationalizations the change in average Lerner indices and average net interest margins. Figure 1 also shows the corresponding change for the control group, defined as countries without crises and not being subject to interventions over the same period. Each subpanel illustrates the effect of one intervention. Treatment countries are represented by triangles and ISO codes, and squares depict the control group. All countries whose ISO codes are below the zero line have contractions in competition. For example, Thailand issued blanket guarantees in 1997 (at the bottom left-hand corner in the left hand side of Figure 1 in the panel with blanket guarantees) when the Lerner index dropped by 0.14. At the same time, the control group experienced an increase in the Lerner index by 0.04.

[FIGURE 1: Effects of interventions on Lerner indices and net interest margins]

The empirical patterns are striking. Many countries experience reductions in competition following interventions. Increases in competition occur primarily after recapitalizations and liquidity support, but nationalizations also reduce margins. Yet, the

effects are not uniform. While several countries display substantial declines in competition, some countries only experience marginal declines or even increases in competition, suggesting the effects of interventions are amplified or mitigated depending on other characteristics that vary on the country level. We explore these issues in our Supplementary Appendix, Tables A.8 and A.9.

B. Identification strategy

We now turn to difference-in-difference estimations to compare treatment countries, i.e., countries which experienced interventions with countries in a control group before and after the treatment. The control group consists of countries without interventions (i.e., non-crisis countries). Our estimator considers the time difference of the group differences, i.e., it accounts for omitted variables that affect treated and untreated countries alike. For example, Basel II may coincide with changes in competition, but as such changes affect all banks, the estimator only attributes the *additional* changes in competition to interventions. We use a standard difference-in-difference setup and estimate

$$C_{it} = \alpha + \beta I_{it} + \rho X_{it} + A_i + B_t + \varepsilon_{it} \quad (1)$$

where the dependent variable C_{it} denotes competition in country i during year t. The panel structure permits inclusion of dummy variables to eliminate time-varying omitted variables. We include country *(A)* and year dummy variables *(B)* to capture cross-country heterogeneity and year fixed effects. The country fixed effects net out any time-invariant unobserved country-specific factors. The year fixed effects difference away trends that affect treatment and control group countries such as changes in contestability, and changes in technology that could affect competition over time. The vector X captures time-varying country level control variables explained below, and ε_{it} is the error term. Our coefficient of

interest is β for the dummy that equals one in the years affected by the intervention I (blanket guarantee, liquidity support, recapitalization, nationalization), or zero otherwise.[4] The slope β provides information about the effect of interventions. Our measures of competition are decreasing in competition. A positive coefficient suggests decreases in competition, whereas a negative slope signals increases in competition.

The vector of control variables X contains determinants of competition. Concentration affects competition (Claessens and Laeven (2004)). We therefore include an asset-based Herfindahl-Hirschman index (HHI). Since we compare HHIs across markets, we also include banking system assets (ln) to account for industry size. Moreover, we include a dummy for assisted mergers because several countries resolve troubled banks by merging them with healthier institutions. These mergers are likely to affect market structure and may indirectly also affect the way banks compete.

To account for the government's role in formulating regulation, we use a regulatory quality index which is increasing in regulatory quality, and is normalized between -2.5 and +2.5 (Kaufmann, Kraay, and Mastruzzi (2009)). Provided that interventions are more pronounced when banking systems play a bigger role in the economy, we also include a dummy that takes on the value of one if Beck, Clarke, Groff, Keefer, and Walsh (2001) classify a financial system as bank-based, and an index ranging from 1 to 3 that classifies the depth of a banking system by provision of domestic credit (scaled by GDP). We also

[4] The interventions are collinear as many of them are adopted at the same time (Supplementary Appendix A.1). While only 13.5% of crises countries adopt one measure, 25% adopt at least two types of rescue measures; over 31% announce three measures. All four types of interventions are used by 30% of the countries. We cannot include them in the same regression and therefore estimate regressions separately for each intervention. See also Table 3 for the inclusion of a dummy that takes on the value of one if any one of the four types of interventions was observed.

control for loan impairment charges to loans as reductions in interest income during crises can reduce Lerner indices and net interest margins.

Since many countries adopt multiple interventions, we also include a dummy for multiple interventions that takes on the value of one if a country experienced more than one intervention. This variable mitigates concerns that the coefficient for the individual intervention is confounded by the other three interventions excluded from the regression.

Finally, it is important to consider macroeconomic conditions. Beyond controlling for GDP growth, inflation, and real GDP per capita, it is important to recognize that central banks often use monetary policy to mitigate the strain on the financial system during crises (Landier, Sraer, and Thesmar (2013)). A government's fiscal situation also plays a role for the ability to bail out banks, and changes in the exchange rate may also affect competition in banking. Since these factors are likely to have, at least indirectly, some bearing on the outcomes we study, we include short-term real money market rates (ln) as a proxy for monetary policy. Approximating monetary policy with short-term interest rates is in line with the literature about the bank lending channel (Bernanke and Blinder (1992); Kashyap and Stein (2000)), and recent work on the risk-taking channel (Jimenez et al. (forthcoming)). To account for governments' ability to bail out banks, we control for government debt to GDP, and we also include the change of the exchange rate, measured in local currency units per USD in the regressions.[5] Table 1 shows summary statistics. All variables, except for the dummy variables, are winsorized at the 1st and 99th percentile.

[5] While all regressions that include control variables contain a measure of monetary policy, the real short-term money market rate (ln), additional robustness tests presented in Supplementary Appendix Table A.4 contain a variable which measures if the central bank engaged in expansionary monetary policy, and a variable that captures increases in public debt during crises. Our key coefficients of interest remain unaffected in these analyses.

[TABLE 1: Summary statistics]

Difference-in-difference estimations require two assumptions. First, assignment to treatment is plausibly exogenous with respect to competition, suggesting competition is not driving the interventions. Second, in the absence of treatment, changes in competition are similar for treatment and control groups. This is the "parallel trends" assumption.

We first examine the exogeneity of the interventions. Table 2 presents Cox proportional hazard models to estimate the conditional probability of interventions. Our key explanatory variable captures competition (measured by the Lerner index in Panel A and by the net interest margin in Panel B) prior to the intervention, and we also include the control variables discussed above. We focus on the time from the start of our sample to the occurrence of interventions. The hazard rate $h(t)$ represents the likelihood that an intervention is observed at time t in country i, given that there was no intervention until t. In employing duration analysis, we can impose a structure on the hazard function. Since we have no reason to assume duration dependence in the data, we use a Cox model that does not impose a shape on the hazard function. The model takes the form

$$h(t|x_i)=h_0(t)exp(x_i\beta_x) \quad (2)$$

where $h_o(t)$ denotes the baseline hazard, and β_x is the vector of parameters. A positive coefficient for the competition measure increases the hazard of interventions. Panel A in Table 2 reports the results for Lerner indices, and Panel B shows the effects for net interest margins. The competition measures remain insignificant.[6]

[TABLE 2: Exogeneity of interventions, correlations, and parallel trends]

[6] All interventions are positively correlated (Table 2, Panel C).

We next examine the parallel trends assumption. It requires similar changes in competition between countries with interventions and the control group. This assumption does not require identical levels of competition between treatment and control groups, they are differenced out. Figure 2 shows patterns that support parallel trends, and Panel D in Table 2 presents *t*-tests in the spirit of Lemmon and Roberts (2010) for differences in means for changes in the competition measures between treatment and control groups over the three years prior to interventions. All *t*-tests remain insignificant.

[FIGURE 2: Parallel trends: Behavior of competition measures]

C. Main results

Table 3 presents our main results for the Lerner index (Panel A) and the net interest margin (Panel B) using annual data. We cluster heteroskedasticity-adjusted standard errors on the country level to allow for serial correlation in the errors. We drop countries with multiple crises (Russia and Ukraine).

[TABLE 3: The effect of government interventions on banking competition]

All coefficients for the interventions enter negatively. While the inclusion of controls increases the estimation efficiency and reduces error variance, their inclusion has little effect on the key coefficients. All subsequent analyses always include controls. Liquidity support and recapitalizations are significant in Panel A, and they increase competition. Panel B confirms the competition-increasing effects for liquidity support, recapitalizations, and nationalizations.

While an extensive discussion of the effects of all control variables is not possible due to space constraints, the fact that neither concentration nor the dummy for assisted bank mergers enter significantly is worth pointing out. A number of countries used mergers to

resolve ailing institutions which should result in an increase in concentration, and industrial economics theory suggests a corresponding reduction in competition. This, however, contrasts with our finding of increases in competition. In tests relegated to Supplementary Appendix Table A.5, we explore this empirically and regress the HHI on the dummy for assisted mergers and all control variables, except the HHI. The tests do not support the idea that assisted mergers increase concentration, a result we believe reflects too low a number of assisted mergers in our large cross-country study.[7]

The magnitudes of the coefficients are economically meaningful. We illustrate the effects based on the regressions including control variables. First, the coefficients for liquidity support (-0.033) and recapitalizations (-0.039) are considerable given the within-country standard deviation of the Lerner index of 0.050. Likewise, the coefficients for liquidity support (-0.028), recapitalizations (-0.034), and nationalizations (-0.039) also seem large bearing in mind that the within-country standard deviation of the net interest margin is 0.054. Second, the coefficients trigger location shifts in the distribution of the relative ranking in terms of the competitiveness of the individual countries. Thailand represents the median country in terms of the Lerner index. Provision of liquidity support in 1997 reduces the Lerner index from 0.221 to 0.189, a level equivalent to Australia, located at the 33rd percentile. Similarly, nationalizations shift the average net interest margin of 0.055 in Latvia in 2008 to 0.017, the level of the Slovak Republic, located at the 27th percentile.

The volumes of liquidity support (in % of deposits and foreign liabilities) and recapitalizations (in % of GDP) may also matter for competition. We run *t*-tests to compare

[7] Note that the idea in industrial economics that competition and concentration are inversely related has found very little support in empirical work in banking. For instance, Claessens and Laeven (2004) find a positive and significant correlation between competition and concentration.

changes in competition for countries where the volumes of liquidity support and recapitalizations are below and above the median. The volumes do not matter. For liquidity support, the *t*-tests display values of 0.61 for the Lerner indices and -1.37 for the net interest margins. For recapitalizations, the *t*-tests are -0.24 and -0.09, respectively.

Blanket guarantees remain insignificant. Guarantees which are not accompanied by other measures may not be credible, foreign creditors tend to ignore them, and some countries introduced unfavourable tax policies, e.g., Ecuador.

The last columns in Panel A and B replace the individual dummies for the four interventions with a dummy that takes on the value of one if any one of these four measures is observed. The idea is to consider whether any intervention, irrespective of its specific design, signals future bailouts to the industry and shifts conduct towards more competition. These tests indeed point towards competition-increasing effects.

D. Alternative explanations

Next, we confront alternative explanations. A common shock, i.e., a banking crisis, rather than interventions may affect competition. However, we show in Section III.B that our data satisfy the key identification assumption of parallel trends. Further, not all coefficients display the same effect. If interventions serve as a proxy for crises, they should display similar magnitudes. This is not the case. An *F*-test for the null that the coefficients on the four interventions are equal across the regressions is rejected at the one percent significance level ($\chi 2$-value: 11.57, *p*-value: 0.00). Moreover, crisis durations are short (3.03 years) whereas interventions remain in place for many years. For example, blanket guarantees lasted 78 months in Indonesia. On average, blanket guarantees are in place for 5.2 years, and the public sector retained its equity participation for over 10 years in Japan.

We first examine whether our results are driven by systemic crises. The first test in the first subpanel in Table 4 replicates the main regressions but excludes countries with systemic crises. We only consider interventions in countries with borderline crises. The test reduces the number of interventions, but we still obtain competition-increasing effects for liquidity support and recapitalizations for the Lerner index. Likewise, we confirm a negatively significant effect of nationalizations on net interest margins. There are no blanket guarantees in countries with borderline crises. An alternative way to investigate whether our results reflect responses to systemic crises is to omit the most costly crises, i.e., those with the greatest rescue cost in % of GDP. If so, removing these countries should render our key coefficients insignificant. Omitting countries where rescue cost are equal to or exceed the 75th percentile of the rescue cost in the second test of the first subpanel leaves the key results intact.

Our regressions already adjust for monetary policy by controlling explicitly for short-term interest rates to mitigate concerns that lower interest rates during crises are responsible for our findings. To further analyze the role of interest rates, the second subpanel of Table 4 presents a test that helps better separate the effect of monetary policy on competition from the effects arising from the four direct forms of intervention by restricting the analysis to countries in the Eurozone. These countries have a common monetary policy. Since the sample size collapses to 125 observations, the results need to be taken with a note of caution. However, we are still able to document competition-increasing effects from liquidity support and nationalizations in the tests for the Lerner index and from blanket guarantees and recapitalizations for net interest margins.

A final alternative explanation for our results may arise from large degrees of government ownership of the banking system. In particular, nationalizations give banks a competitive advantage to attract funds because government ownership comes with a subsidy arising from implicit guarantees (Acharya and Kulkarni (2013)). In other words, the increase in competition we find may be influenced by countries where governments own large parts of the banking system. If this phenomenon is responsible for our findings, removing countries with large shares of government ownership should render our key coefficients on nationalizations insignificant. The last subpanel in Table 4 removes country-year observations where the degree of government ownership exceeds the 75th percentile of this variable. The sample size is reduced but the findings for the Lerner index are unchanged. Blanket guarantees now are weakly significant and also reduce net interest margins, while liquidity support becomes insignificant.

[TABLE 4: Robustness: Alternative explanations]

E. Falsification tests, placebo tests and the role of demand conditions

Table 5 presents falsification and placebo tests, and also investigates the role of demand effects. The first subpanel shows falsification tests. The idea is to establish that the significant effects from government interventions can only be observed when governments really intervene. Our first falsification test rules out that any type of crisis affects the evolution of competition between treatment and control groups differently. To this end, we find an event that increases competition but is unrelated to crises and then assign placebo interventions. We eliminate the key confounding factor, i.e., crisis observations from our sample, and look for instances where we observe a decline in an index which provides information about restrictions on bank activities (Barth, Caprio, and Levine (2004)). The

index increases in restrictiveness, ranging from 3 to 12. It provides information about banks' ability to engage in non-traditional activities (securities, insurance, and real estate), and restrictions on conglomerates. Since relaxations in activity restrictions increase competition we can analyze if such drops create similar treatment-control group patterns that we uncover in our main tests with the difference that the placebo interventions do not coincide with crises. If this falsification exercise yields significant effects, we could not rule out that effects like deregulation create similar patterns in the data. The placebo interventions are assigned to the first year in which a country relaxes activity restrictions. The durations of these placebo interventions are randomly generated based on the durations of the actual durations of the four interventions. To avoid confounding effects of multiple relaxations of activity restrictions per country, we omit countries with multiple reductions of the index, resulting in 37 placebo interventions. None of these placebo interventions displays significance.

Our second falsification test simulates fake crises, defined as periods of at least three consecutive years of declines in bank capital during periods when our database does not classify a country as having had a crisis. We assign placebo interventions to the first year in which a country experienced a fake crisis, and the durations of these placebo interventions are randomly generated using the distributions of the actual durations of the interventions. The coefficients on the placebo interventions remain indistinguishable from zero.

The second subpanel offers a standard placebo test where we pretend the interventions occurred two years prior to the actual occurrence. The idea behind this analysis is to lend more support to the key identifying assumption of parallel trends. The placebo treatments should remain insignificant. This is the case.

The same subpanel also focuses on pro-competitive restructuring policies in the EU. If our findings are driven by forced divestments, and other measures by the EU to maintain a level playing field of competition following interventions, removing these countries should render our key coefficients insignificant. This is not the case.

To rule out that demand effects drive our results, the final subpanel shows auxiliary tests for associations between Lerner indices and net interest margins as dependent variable and GDP growth as a proxy for demand conditions as explanatory variable. Loan demand may be weak or banks may be risk-averse and shift lending to higher quality borrowers during crises. Such behavior may reduce Lerner indices and net interest margins. We first run tests of competition measures on GDP growth and year and country dummies for the full sample. Subsequently, we show the results for subsamples that omit crises but constrain the tests to recession periods (defined as at least two consecutive years of contractions of GDP growth). All correlations remain insignificant. These tests mitigate concerns that poor demand causes the declines in Lerner indices and net interest margins.[8]

[TABLE 5: Robustness: Falsification tests, placebo tests, and demand conditions]

F. Long-run effects of government interventions

We acknowledge in Section III.D that the duration of the policy measures goes beyond the duration of the crises. To lend further support to the idea that competitive effects are

[8] Our Supplementary Appendix contains further sensitivity checks. Table A.6 examines alternative ways of clustering standard errors by years, and we include additional control variables to consider that some countries set up asset management agencies. We also test if the too-big-to-fail and the too-many-to-fail phenomena drive our findings, and we examine subsamples of countries which omit high income economies and emerging market economies. Further tests weight our regressions with the inverse of the number of interventions per country to assign less importance to countries with multiple interventions, and we also include a dummy variable for the onset of a crisis as the interventions may occur following the year after the crisis struck. Table A.7 replicates our tests with an alternative measure of competition, the Panzar and Rosse (1987) H-Statistic, which gauges revenue elasticities with respect to changes in input prices. Our key results remain very similar across these additional tests.

not reversed, Figure 3 traces the evolution of average values of the competition measures in countries that had interventions over the five years following their announcement.

[FIGURE 3: Long–run effects]

The dark bars represent competition in the announcement year of the intervention. The light bars track competition measures over the five subsequent years. Lerner indices remain below the initial level following the interventions. The effects are particularly strong in the first three years. While there is some reversal in the fourth and fifth year when considering the Lerner index, interest margins experience a hefty drop in the first two years (with the exception of blanket guarantees), and remain compressed.

Table 6 shows regressions that measure competition one (t+1), three (t+3), and five (t+5) years after interventions. For Lerner indices, we find competition-increasing effects at *t+1* (liquidity support and recapitalizations), persistent effects at t+3 and even at *t+5*, when nationalizations still enter significantly. For interest margins, the tests suggest the effects materialize quickly. Most coefficients at t+1 and t+3 are insignificant. At t+5, blanket guarantees, recapitalizations, and nationalizations display again significance.[9]

[TABLE 6: Long-run effects]

[9] We present extensions in our Supplementary Appendix. Table A.8, Panel A, establishes heterogeneous responses to the interventions by considering whether initial market characteristics in terms of structure, contestability, and moral hazard amplify or mitigate the effects. Increases in competition are greater in magnitude in concentrated markets but the negative relation between interventions and competition is mitigated in countries with more foreign banks. Reductions in the Lerner index tend to be larger in systems with more entry restrictions. Panel B in Table A.8 focuses on the question whether interventions undermine market discipline. We use a Transparency index, ranging from 0 to 5 (Barth et al. (2004)) which consists of a dummy that takes on the value of one if an external audit is required and an accounting index which increases in the quality of bank accounts. We interact this Transparency index with the intervention dummies. Except for blanket guarantees for Lerner indices, all coefficients for the interaction terms enter significantly positively. This suggests that the effects of interventions are mitigated as transparency increases. Table A.9 examines theories by Keeley (1990) and Cordella and Yeyati (2003) which assign a role to charter values for banks' incentives to compete. To this end, we interact charter values, reflected in the ratio of current deposits to total deposits, and money market and short-term funding, with interventions. Neither charter values nor the interaction terms enter significantly.

G. Instrumental variable regressions

Interventions may be endogenous to the depth of the crisis, and are therefore not randomly assigned. This lack of random assignment constitutes an endogeneity problem. We address this issue with instrumental variables and show results from a two-stage estimator. We use a linear probability model in the first stage, and use the same set of instruments for all interventions. The second stage uses the estimated probabilities.

Our instruments draw from different strands of literature. First, Brown and Dinc (2005) show bailouts occur after elections, whereas the period before an election reduces the likelihood of interventions. Two instruments capture the electoral cycle. The first one is a dummy that takes on the value of one in the year of parliamentary elections, and the second one provides information about the time (years) since the last parliamentary election. Both variables should correlate negatively with interventions. A further instrument provides information about the orientation of the largest government party. We use a dummy that takes on the value of one if the largest government party has a right-wing orientation. Governments led by such parties focus on market-oriented policies to increase chances of re-election (Bortolotti and Faccio (2009)). Moreover, their partisan orientation impacts bailout propensities. While left-wing governments are keen to intervene into the economy to preserve jobs, right-wing governments oppose such actions (Garrett and Lange (1991)). As an additional variable we use population (log) to reflect on the fact that countries with fewer inhabitants such as Ireland and Iceland deployed bank rescue packages as their financial sector is large relative to the economy. This relationship is less pronounced in larger economies. We expect a negative coefficient.

Second, we build on the idea that the regulatory architecture matters for bailouts. We use a prompt corrective power index to capture legal requirements that establish levels of bank solvency deterioration that trigger regulatory enforcements and the scope of supervisors in applying such powers. The index increases in corrective power, ranging from 0 to 6. We expect powerful regulators to press for bailout packages. In addition, we also use information about the number of bank supervisors with more than ten years of experience as such key staff is more likely to detect the build-up of problems and take corrective measures in the banks prior to the evolution of crises. We expect a negative sign. Moreover, a regulator with a large budget is also more likely to embark on rescue activities. Thus, we include the budget of the supervisory agency and expect a positive coefficient.

Third, we consider Europe specifically where concerns about crisis contagion have been prominent. We include a dummy for EU membership, and we also include a dummy for a crisis in a contiguous country. To reflect on the problems in Europe, we use an interaction term between these variables and expect a positive sign. Finally, we exploit ideas according to which bailouts occur because of doubts about the accuracy with which markets assess bank asset value. Flannery, Kwan, and Nimalendran (2013) claim interventions occur because markets cannot differentiate between sound and unsound banks. This spike in information asymmetries motivates bailouts. To capture opacity, we focus on asset composition and examine banks' securities portfolios. As instruments, we use available for sale (AFS) and held to maturity (HTM) securities, scaled by total securities. The former are marked at fair value and should reduce opacity and the likelihood of interventions. The latter are reported at amortized cost, and make balance sheets more opaque.

Panel A of Table 7 confirms our previous results. While the sample size shrinks due to the availability of instruments and we remain therefore cautious assigning weight to these tests, we confirm all previous effects for net interest margins.

Panel B shows the 1st stage. All instruments exhibit the anticipated sign and are significant in at least one of the first stage regressions, except for the number of supervisors with more than ten years of experience and the dummy for crises in contiguous counties. The Hansen *J*-statistic for the null that the instruments are uncorrelated with the error cannot reject their exogeneity with the exception of the regression for blanket guarantees and nationalizations for net interest margins. All first stage *F*-tests are above the rule of thumb of ten, and the Kleibergen-Paap tests reject weak instruments. For all specifications, we obtain statistics above the tabulated critical values for a size bias of ten % relative to OLS.

[TABLE 7: Instrumental variable regressions]

H. Heckman selection regressions

The fact that government interventions only occur in response to crises but not otherwise may also give rise to a selection problem, another potential source of bias. This section presents results from a Heckman selection model (Heckman (1979)) to mitigate such concerns. To reflect on the fact that interventions can only be observed during crises, we model first the occurrence of a crisis (zero otherwise). We use two variables that are excluded from the second stage equation. These two covariates should satisfy the criterion that they validly predict the occurrence of banking crises but do not directly affect competition. Our first variable is the ratio of M2 to foreign reserves. Demirgüç-Kunt and Detragiache (1998) show that crises are more likely in countries prone to sudden capital

outflows. The second variable is credit growth, in real terms, deflated by the CPI (lagged by one year). The growth rate is based on annual changes in credit from the banking system to the private sector. Reinhart and Rogoff (2009) have shown that crises are preceded by credit booms.

Table 8 presents the results from the two-stage Heckman selection models. The 1st stage regressions are identical across the four different government interventions and we only report them once per panel. The ratio of M2 to reserves enters significantly with the anticipated positive sign for the effect on banking crises, and so does credit growth. The coefficients on the key variables of interest in the second stage tend to be greater than those obtained with the difference-in-difference regressions, and they are also larger than those from the instrumental variables tests. However, the inverse Mills ratio remains insignificant, and does not point towards selection problems.

[TABLE 8: Heckman selection regressions]

IV. Evolution of zombie banks

We now examine what drives the shift towards competition. It is plausible to assume that interventions keep unviable banks in business as a going concern. If so, the Schumpeterian process of creative destruction is suppressed, and insolvent zombie banks can keep on originating risky loans with negative net present values but substantial upside potential (Kane (1990)). Limited liability in combination with government support puts them in a no-lose situation. Zombies are incentivized to prey on their rivals' market shares. If these conjectures are true, we should find positive associations between the evolution of zombie banks and government interventions.

For this analysis, we use two alternative definitions of zombie banks. The first definition uses book values of equity to classify zombie banks. We compute banks' tangible capital as common equity minus intangible assets, consisting of goodwill, other intangibles, and deferred tax assets (Kroszner and Strahan (1996)). Next, we code a dummy that takes on the value one if tangible capital is negative, and then calculate these zombie banks' market shares for deposit and loan markets.

Our alternative definition of zombie banks relies on market values based on the market capitalization for common and preferred shares. We use market data because book values of equity for banks may be sticky, in particular during crises when regulators may forbear. The use of market data is however not without disadvantages. In our large cross-country sample with many emerging markets, only 2,138 of the 21,988 banks are publicly listed. Moreover, any analysis using market data excludes medium-sized and small banks which are less likely to be listed, resulting in a substantially reduced and less representative sample. With these caveats in mind, we define a zombie bank based on market values of bank equity as a bank whose liabilities exceed the market value of equity. We view the tests using market data as a sensitivity check for the inferences obtained from the book values of bank equity. The correlations between the market based measures of zombie banks and those based on book values are 0.16 (*p*-value 0.011) for deposit market shares, and 0.12 (*p*-value 0.058) for the loan market shares.

Figure 4 shows the evolution of zombie banks for the 5 years following the government interventions. The four panels on the left focus on zombie banks using the definition based on book values, and the four panels on the right illustrate the evolution of zombie banks using market data. Using book values, we find that zombie banks increase market shares

after interventions until the second and third year and only then their market shares start to decline. In the second year, zombie banks that are not dismantled increase market share to up to 9% in the case of blanket guarantees. For liquidity support, recapitalizations, and nationalizations, zombie banks' market shares increase to 5%. The patterns for market data are similar, except for a less pronounced decline in years 4 and 5, which is likely a reflection of market values of bank shares remaining compressed after crises. Nevertheless, despite the reduced sample size, the findings using the market based measures for zombie banks largely reinforce the inferences from the tests using book values.

[FIGURE 4: Evolution of zombie banks]

Table 9 shows regressions with the market shares of zombie banks as dependent variables. We present tests based on book values and market values. We show the results for the full sample using the deposit market share in Panel A and the loan market share in Panel B. None of the coefficients is significant. Panel C and Panel D restrict the sample to crisis countries to focus on the variation over time in zombie banks' market shares within crisis countries because the effects from interventions, if any, on zombie banks should be more pronounced. Liquidity support and recapitalizations are now positively and significantly associated with the market shares for deposits and loans of zombie banks in the analyses based on book values. The tests relying on a market based definition of zombie banks offer some evidence for a weakly significant and positive effect of recapitalizations and nationalizations on deposit and loan and market shares, respectively.

Additional tests lend more support to the idea that zombie banks evolve simultaneously with interventions. Panel E and F illustrate a largely monotonous relationship between the frequency of interventions and zombie banks' market shares. While these results may

simply be a reflection of crisis intensity, Panel G and H challenge this view. Large increases in competition (in terms of the declines of Lerner indices and net interest margins) coincide with greater presence of zombie banks. Taken together, these tests offer some evidence that zombie banks seem a driving force behind the increase in competition by collectively increasing market shares and crowding out healthy competitors.

[TABLE 9: Zombie banks]

V. Effects of interventions on depositors and borrowers

Our tests so far focus on producer welfare. We now examine how consumers are affected. While stabilizing effects arise from the interventions as they help restore confidence and avoid disruptive bank closures, our emphasis is on pricing effects. This analysis allows evaluating which parties benefit from increases in competition. Further, we can test whether increases in competition are driven by supplanted market discipline which shows up in lower deposit rates or by moral hazard, reflected in lower loan rates.

A. Pricing effects: Loan and deposit rates

Table 10 documents pricing effects. We replace the competition measures as dependent variables with average deposit and average loan rates, computed by dividing interest expenses by total deposits and money market funding, and interest income by total loans. Panel A shows that liquidity support, recapitalizations, and nationalizations reduce funding costs. This is not surprising. The interventions not only make banks safer and depositors consequently require lower returns but they also undermine market discipline which additionally contributes to lower funding costs. In addition, the findings for the rate-reducing effect from recapitalizations also support the theory by Allen, Carletti, and Marquez (2011). They propose more capital enables banks to compete more effectively.

Our analysis of loan rates in Panel B documents moral hazard. We find rate-reducing effects for liquidity support and recapitalizations. The latter is consistent with Black and Hazelwood (2013). They show TARP banks charge lower rates. Nationalizations also reduce loan rates (Sapienza (2004)). Our tests highlight the disparate effects. While interventions help borrowers, they harm depositors. Moreover, the magnitudes of the coefficients in the loan rate equations tend to be greater than in the deposit rate equations. Thus, the moral hazard effect dominates advantages from supplanted market discipline.[10]

Next, we revisit our argument that zombie banks drive competition. If so, the effects of interventions on interest rates should be less pronounced once we omit years with zombie banks, but should be greater once we examine only countries with zombies. Indeed, the magnitudes decline in Panel C and D when we drop years with zombie banks, measured using book values. In contrast, they increase in Panel E and F where we focus on countries that have at least one year of data with zombie banks, again measured using book values.

[TABLE 10: Pricing effects: Deposit and loan rates]

B. Pricing effects: Alternative explanations

Table 11 addresses alternative explanations. The results for the effects on deposit and loan rates may be affected by flights to safety from non-bank depositors to government-supported banks. Moreover, some countries increased deposit insurance coverage in recent years which could also affect customers' propensity to deposit their savings with banks. Panel A in Table 11 demonstrates that deposit volumes do not significantly differ in the years prior to and following interventions, i.e., declines in deposit rates are unlikely to

[10] As an alternative way to examine this, Table A.10 in the Supplementary Appendix shows the components of the Lerner index, marginal cost and the product price as dependent variables. Prices are reduced and marginal costs decline. The coefficients for price declines tend to be greater than the reductions in marginal cost, thus banks' market power shrinks and competition increases.

be driven by increased deposit supply. In Panel B, we remove countries whose deposit insurance coverage limits increased. This test supports our previous inferences, with greater magnitudes for the key coefficients. Panel C revisits the concern that the subsidy which comes with government ownership of banks drives the lower interest rates by omitting observations where government ownership of the banking system exceeds the 75th percentile. The interventions are insignificant in the tests for deposit rates (except for nationalizations which are weakly significant), suggesting that government ownership plays a role for the pricing effects. Loan rates remain significantly affected in this test. Thus, while there is evidence that government ownership reduces funding costs and the pricing effects for deposit rates are not necessarily a consequence of interventions, the causal effect of interventions on loan rates remains intact.

[TABLE 11: Pricing effects: Alternative explanations]

VI. Concluding remarks

The effects of government aid for the banking sector are not yet well understood. We show how blanket guarantees, liquidity support, recapitalizations, and nationalizations affect banking competition. In addition, we show how zombie banks evolve following such interventions, and we evaluate how interventions affect the pricing of deposits and loans.

Our result suggests that reservations by policymakers that interventions reduce banking competition are overstated. Liquidity support, recapitalizations, and nationalizations increase competition. This is important because the pro-competitive effects may increase real investment, and such effects might offset much of the deadweight cost associated with government support. We also find some indication in the data that zombie banks play a role for increases in competition. In countries struck by crises, we show that their market

shares are positively correlated with liquidity support, recapitalizations, and nationalizations. We also find that the frequency of interventions coincides with greater market shares of zombie banks.

We acknowledge two limitations. First, our data do not consider how interventions are administered. We cannot establish whether capital support was provided to the weakest banks in some countries while it may be given to healthier ones elsewhere. Second, our tests leave open the possibility that unobservables which coincide with the interventions drive our inferences.

Our second key result is that borrowers and depositors are affected disparately. The finding that interest margins are reduced is driven by lower loan rates, suggesting moral hazard. In contrast, there is little evidence that deposit rates are reduced as a consequence of interventions. While we also find reductions of deposit rates, this result is primarily driven by government ownership.

In sum, banks' conduct following government aid is conditional on the government measures. Beyond prolonged and misdirected support of zombie institutions which causes congestion as they prevent the exit of insolvent institutions, government interventions shape banks' expectations about future interventions. Reducing bailout expectations, tying government assistance to the restructuring of troubled assets, identifying zombie banks via stress tests, and facilitating their exit via resolution mechanisms are important avenues for policy reform and future research.

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Table 1
Summary statistics

Variable	*N*	*Mean*	*p5*	*p95*	*S.D.*	*Source*
Dependent variables						
Lerner index	1687	0.247	0.082	0.483	0.117	BankScope, authors' calculations
Net interest margin	1687	0.064	0.001	0.217	0.087	BankScope, authors' calculations
Deposit market share of zombie banks (book values)	1528	0.013	0	0.041	0.075	BankScope, authors' calculations
Deposit market share of zombie banks (market values)	257	0.043	0	0.101	0.030	BankScope, authors' calculations
Loan market share of zombie banks (book values)	1528	0.014	0	0.039	0.079	BankScope, authors' calculations
Loan market share of zombie banks (market values)	257	0.041	0	0.092	0.028	BankScope, authors' calculations
Deposit rate	1687	0.134	0.007	0.395	0.283	BankScope, authors' calculations
Loan rate	1687	0.208	0.040	0.798	0.289	BankScope, authors' calculations
Key variables						
Blanket guarantee	1687	0.069	0	1	0.255	Laeven and Valencia (2010, 2013)
Liquidity support	1687	0.136	0	1	0.343	Laeven and Valencia (2010, 2013)
Recapitalizations	1687	0.145	0	1	0.353	Laeven and Valencia (2010, 2013)
Nationalizations	1687	0.127	0	1	0.333	Laeven and Valencia (2010, 2013)
Control variables						
Concentration (HHI)	1687	0.321	0.082	0.870	0.229	BankScope, authors' calculations
Total banking system assets (ln)	1687	9.837	5.524	14.700	2.748	BankScope, authors' calculations
Assisted mergers	1687	0.014	0	1	0.120	Laeven and Valencia (2010, 2013)
Regulatory quality index	1687	0.230	-1.115	1.730	0.876	Kaufmann et al. (2009)
Bank-based financial system	1687	0.759	0	1	0.427	Beck et al. (2001)
Financial development indicator	1687	1.987	1	3	0.831	World Bank Development Indicators, authors' calculations
Loan impairment charges/Loans	1687	0.015	0	0.046	0.027	BankScope, authors' calculations
Multiple interventions	1687	0.026	0	0	0.161	Laeven and Valencia (2010, 2013)
GDP growth	1687	0.042	-0.027	0.102	0.042	World Bank Development Indicators
Inflation	1687	0.074	-0.003	0.218	0.133	World Bank Development Indicators
Real GDP/Capita	1687	7669.311	234.713	31290.27	10259.77	World Bank Development Indicators
Real money market rate (ln)	1687	1.470	-1.375	3.348	1.933	World Bank Development Indicators
Government debt /GDP	1687	56.662	11.785	120.249	35.736	International Financial Statistics
Exchange rate	1687	0.011	-0.031	0.096	0.442	World Bank Development Indicators
Other variables						
Foreign-owned banks (assets in %)	1588	0.356	0	0.913	0.302	Barth et al. (2001, 2004)
Activity restrictions index	1313	6.771	4	10	1.785	Barth et al. (2001, 2004)
Entry restrictions index	1332	7.427	6	8	1.099	Barth et al. (2001, 2004)
Explicit deposit insurance	1326	0.658	0	1	0.474	Barth et al. (2001, 2004)
Transparency index	1142	4.498	3	5	0.656	Barth et al. (2001, 2004)
Instruments and identifying covariates						
Election year	929	0.210	0	1	0.408	Parties and Elections, Center on Democratic Performance, Electionresources.org
Time since last election	929	2.510	0	8	2.392	Parties and Elections, Center on Democratic Performance, Electionresources.org
Government party with right-wing orientation	929	0.326	0	1	0.469	Parties and Elections, Center on Democratic Performance, Electionresources.org
Population (log)	929	16.341	13.895	18.830	1.555	World Bank Development Indicators
Prompt corrective power	929	2.452	0	6	2.491	Barth et al. (2004)
Bank supervisors > 10 years of experience	929	78.856	2.5	266.6	214.391	Barth et al. (2004)
Budget for supervision	929	424.894	0.096	424.894	2667.968	Barth et al. (2004)
EU member country	929	0.1553	0	1	0.362	European Commission
Contiguous country with crisis	929	0.053	0	1	0.225	Laeven and Valencia (2010, 2013); CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
AFS securities/Total securities	929	0.604	0	0.442	0.564	BankScope, author's calculations
HTM securities/Total securities	929	0.280	0	0.493	0.036	BankScope, authors' calculations
M2/Foreign reserves	1687	0.335	0	0.775	0.198	Wolrd Bank Development Indicators
Real credit growth (t-1)	1687	0.110	-0.132	0.440	0.176	International Financial Statistics

Table 2

Exogeneity of government interventions with respect to competition, correlations, and tests for parallel trends

We present Cox proportional hazard (Cox PH) models to verify that blanket guarantees, liquidity support, recapitalizations, and nationalizations are exogenous with respect to competition, measured by the Lerner index in Panel A and by the net interest margin in Panel B. The dependent variable denotes the hazard of observing blanket guarantees, liquidity support, significant recapitalizations, or nationalizations. Our sample period is 1996 – 2010. A country is dropped from the analysis once it experienced the intervention of interest. The vector of control variables (not shown) includes an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Country and year dummies are included. Panel C shows correlations between the four dummy variables for government interventions (blanket guarantees, liquidity support, recapitalizations, and nationalizations). Panel D presents *t*-tests for the assumption of parallel trends in changes in the Lerner index and the net interest margin between treatment group countries and the control group for the three years prior to blanket guarantees, liquidity support, recapitalizations, or nationalizations. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Lerner index					**Panel B: Net interest margin**			
	Blanket guarantee	*Liquidity support*	*Recapitalizations*	*Nationalizations*	*Blanket guarantee*	*Liquidity support*	*Recapitalizations*	*Nationalizations*
	Cox PH	*Cox PH*	*Cox PH*	*Cox PH*	*Cox PH*	*Cox PH*	*Cox PH*	*Cox PH*
Competition	0.313	-0.429	-2.292	-3.652	0.283	-1.888	0.203	0.139
	(0.09)	(-0.19)	(-0.94)	(-1.21)	(0.15)	(-1.23)	(0.11)	(0.07)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1430	1363	1327	1361	1430	1363	1327	1361

Panel C: Correlation matrix for government interventions

	Blanket guarantee	*Liquidity support*	*Recapitalizations*
Blanket guarantee	1		
Liquidity support	0.595***	1	
	(0.00)		
Recapitalizations	0.663***	0.780***	1
	(0.00)	(0.00)	
Nationalizations	0.717***	0.822***	0.859***
	(0.00)	(0.00)	(0.00)

Panel D: Parallel trends	*Blanket guarantee*			*Liquidity support*			*Recapitalizations*			*Nationalizations*		
	Treatment	*Control*	*t-test*	*Treatment*	*Control*	*t-test*	*Treatment*	*Control*	*t-test*	*Treatment*	*Control*	*t-test*
Δ Lerner index (*t*-1)	0.054	-0.022	-1.60	-0.000	-0.015	-0.63	-0.004	-0.023	-0.79	-0.005	-0.021	-0.52
Δ Lerner index (*t*-2)	0.016	-0.023	-1.05	-0.040	-0.041	-0.02	-0.044	-0.038	0.17	0.000	-0.030	-1.05
Δ Lerner index (*t*-3)	-0.019	0.017	1.05	0.009	0.029	0.77	0.012	0.030	0.61	0.005	0.024	0.46
Δ Net interest margin (*t*-1)	0.004	0.009	0.29	-0.001	0.003	0.35	-0.004	0.004	0.45	-0.006	0.008	0.59
Δ Net interest margin (*t*-2)	-0.006	-0.002	0.53	-0.006	-0.004	0.59	-0.007	-0.004	0.68	-0.005	-0.004	0.13
Δ Net interest margin (*t*-3)	0.068	0.047	-0.21	0.009	0.008	-0.02	0.011	0.012	0.05	0.021	0.017	-0.11

Table 3
Main results: The effect of government interventions on banking competition

The table presents difference-in-difference regressions of the effect of blanket guarantees, liquidity support, recapitalizations, and nationalizations on competition, measured by the Lerner index in Panel A and by the net interest margin in Panel B. We report regressions excluding and including control variables, and the final column in each panel uses a dummy variable that takes on the value of one if any one of these measures was observed. The control variables are an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Lerner index										**Panel B: Net interest margin**								
	No controls	*With controls*	*No controls*	*With controls*	*No controls*	*With controls*	*No controls*	*With controls*	*Any intervention*	*No controls*	*With controls*	*No controls*	*With controls*	*No controls*	*With controls*	*No controls*	*With controls*	*Any intervention*
Concentration (HHI)		-0.033		-0.033		-0.032		-0.033	-0.033		-0.016		-0.016		-0.015		-0.014	-0.015
		(-1.51)		(-1.52)		(-1.47)		(-1.49)	(-1.49)		(-1.30)		(-1.33)		(-1.27)		(-1.19)	(-1.28)
Total banking system assets (ln)		-0.022**		-0.022**		-0.022**		-0.022**	-0.022**		-0.015*		-0.015*		-0.015*		-0.015*	-0.015*
		(-2.29)		(-2.26)		(-2.30)		(-2.28)	(-2.26)		(-1.71)		(-1.68)		(-1.71)		(-1.73)	(-1.67)
Assisted mergers		0.001		0.002		0.003		-0.003	0.002		-0.009		-0.006		-0.006		-0.003	-0.005
		(0.07)		(0.11)		(0.13)		(-0.15)	(0.09)		(-0.72)		(-0.56)		(-0.57)		(-0.29)	(-0.46)
Regulatory quality index		0.007		0.002		0.002		0.007	0.003		0.003		-0.002		-0.001		-0.002	-0.002
		(0.27)		(0.07)		(0.10)		(0.29)	(0.12)		(0.16)		(-0.13)		(-0.09)		(-0.15)	(-0.13)
Bank-based financial system		0.116***		0.104***		0.114***		0.111***	0.112***		0.044*		0.035		0.044*		0.043*	0.042
		(2.99)		(2.63)		(2.87)		(2.87)	(2.84)		(1.69)		(1.37)		(1.69)		(1.66)	(1.63)
Financial development indicator		0.032		0.024		0.034		0.025	0.031		0.019		0.014		0.023		0.026	0.022
		(0.78)		(0.60)		(0.86)		(0.63)	(0.77)		(0.49)		(0.37)		(0.60)		(0.67)	(0.57)
Loan impairment charges/Gross loans		0.108		0.109		0.107		0.103	0.107		0.492***		0.494***		0.492***		0.494***	0.493***
		(0.72)		(0.74)		(0.73)		(0.68)	(0.72)		(2.77)		(2.81)		(2.81)		(2.81)	(2.81)
Multiple interventions		-0.015		-0.003		0.000		-0.015	-0.005		0.016		0.026		0.029*		0.025	0.028*
		(-0.84)		(-0.16)		(0.01)		(-0.79)	(-0.25)		(1.08)		(1.56)		(1.67)		(1.55)	(1.66)
GDP growth		0.167		0.161		0.152		0.172	0.161		0.042		0.035		0.027		0.032	0.032
		(1.26)		(1.21)		(1.14)		(1.29)	(1.22)		(0.61)		(0.51)		(0.37)		(0.44)	(0.47)
Inflation		0.003		0.003		0.003		0.004	0.004		0.069		0.068		0.068		0.068	0.069
		(0.08)		(0.08)		(0.08)		(0.12)	(0.10)		(1.59)		(1.56)		(1.56)		(1.56)	(1.57)
Real GDP/capita		-0.000		-0.000		-0.000		-0.000	-0.000		-0.000		-0.000		-0.000		-0.000	-0.000
		(-0.26)		(-0.21)		(-0.22)		(-0.27)	(-0.23)		(-1.28)		(-1.22)		(-1.22)		(-1.27)	(-1.23)
Real money market rate (ln)		0.001		0.000		0.000		0.001	0.000		0.003		0.003		0.003		0.003	0.003
		(0.29)		(0.05)		(0.02)		(0.36)	(0.06)		(1.64)		(1.50)		(1.46)		(1.51)	(1.42)
Government debt/GDP		0.001		0.000		0.001		0.001	0.001		0.001		0.001		0.001		0.002	0.001
		(0.50)		(0.24)		(0.55)		(0.32)	(0.48)		(1.09)		(0.87)		(1.34)		(1.45)	(1.31)
Exchange rate		0.009**		0.010**		0.010**		0.010**	0.010**		-0.004		-0.004		-0.004		-0.004	-0.004
		(2.02)		(2.06)		(2.04)		(2.04)	(2.05)		(-0.82)		(-0.79)		(-0.80)		(-0.79)	(-0.79)
Blanket guarantee	-0.031	-0.025								-0.012	-0.014							
	(-1.44)	(-1.04)								(-0.62)	(-0.56)							
Liquidity support			-0.036**	-0.033*								-0.022*	-0.028*					
			(-2.35)	(-1.92)								(-1.68)	(-1.89)					
Recapitalizations				-0.033	-0.043***	-0.039**								-0.026**	-0.034**			
					(-2.65)	(-2.11)								(-2.07)	(-2.23)			
Nationalizations							-0.011	-0.001								-0.032**	-0.039**	
							(-0.62)	(-0.04)								(-2.01)	(-2.13)	
Any intervention									-0.028**									-0.033**
									(-2.00)									(-2.24)
Observations	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687
R2	0.230	0.242	0.233	0.243	0.234	0.244	0.230	0.241	0.243	0.624	0.661	0.626	0.663	0.626	0.664	0.627	0.665	0.665
Number of interventions	11	11	34	34	32	32	26	26	39	11	11	34	34	32	32	26	26	39

Table 4
Robustness: Alternative explanations

This table deals with alternative explanations. The dependent variable is the Lerner index in Panel A and the net interest margin in Panel B. The first subpanel rules out reactions to banking crises. We first run the regressions on a subsample where the treatment countries only include borderline crises. Since blanket guarantees do not occur in countries with borderline crises, we only consider the three remaining interventions. The second test in the first subpanel removes the most costly banking crises. Specifically, we omit countries where the fiscal cost in % of GDP of the crisis is equal to or above the 75th percentile of the distribution of the rescue cost of all crises as an alternative way to verify that our main results are not a reflection of a crisis. The second subpanel focuses on the role of monetary policy. We present difference-in-difference regressions identical to those shown in Table 3 for a sample constrained to countries in the Eurozone. The third subpanel offers a test to mitigate concerns that high degrees of government ownership of the banking system drive our inferences. To this end, we omit country-year observations where the government owns a large proportion of the banking system, defined as government ownership exceeding the 75th percentile of the government ownership variable. All regressions include the control variables explained in the notes to Table 3. Country and year dummies included. Standard errors clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Lerner index									**Panel B: Net interest margins**							
Subpanel: Ruling out reactions to crises by	*Omitting systemic crises*				*Removing costly crises*				*Omitting systemic crises*				*Removing costly crises*			
Blanket guarantee	n/a				-0.028				n/a				-0.013			
					(-1.38)								(-0.43)			
Liquidity support		-0.042**				-0.033*				-0.042				-0.028*		
		(-2.21)				(-1.95)				(-1.37)				(-1.76)		
Recapitalizations			-0.074***				-0.039**				-0.055				-0.034**	
			(-4.30)				(-2.15)				(-1.47)				(-2.10)	
Nationalizations				-0.010				0.000				-0.097**				-0.039**
				(-0.24)				(0.02)				(-2.10)				(-2.00)
Control variables		Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations		1296	1296	1296	1630	1630	1630	1630		1296	1296	1296	1630	1630	1630	1630
R2		0.256	0.258	0.254	0.247	0.249	0.250	0.247		0.678	0.679	0.681	0.663	0.667	0.668	0.668
Number of interventions		11	9	3	7	30	28	22		11	9	3	7	30	28	22
Subpanel: The role of monetary policy	*Sample constrained to Eurozone countries*								*Sample constrained to Eurozone countries*							
Blanket guarantee		0.050								-0.013***						
		(1.08)								(-3.19)						
Liquidity support			-0.080*								0.005					
			(-2.06)								(0.63)					
Recapitalizations				-0.031									-0.012**			
				(-0.51)									(-2.56)			
Nationalizations					-0.093*										0.000	
					(-2.02)										(0.03)	
Control variables		Yes	Yes	Yes	Yes					Yes	Yes		Yes		Yes	
Observations		125	125	125	125					125	125		125		125	
R2		0.338	0.339	0.335	0.355					0.738	0.731		0.738		0.730	
Number of interventions		2	9	6	5					2	9		6		5	
Subpanel: The role of government ownership of banks	*Sample excludes country-year observations where government ownership > 75th percentile*								*Sample excludes country-year observations where government ownership > 75th percentile*							
Blanket guarantee		-0.018								-0.031*						
		(-0.43)								(-1.96)						
Liquidity support			-0.041*								-0.016					
			(-1.82)								(-1.29)					
Recapitalizations				-0.053**									-0.029*			
				(-2.24)									(-1.91)			
Nationalizations					0.007										-0.027*	
					(0.24)										(-1.69)	
Control variables		Yes	Yes	Yes	Yes					Yes	Yes		Yes		Yes	
Observations		1258	1258	1258	1258					1258	1258		1258		1258	
R2		0.263	0.268	0.269	0.263					0.675	0.675		0.676		0.676	
Number of interventions		5	23	22	15					5	23		22		15	

Table 5
Robustness: Falsification tests, placebo tests, and the role of demand effects

This table shows falsification tests and placebo tests, and we also analyze the role of demand effects. The dependent variable is the Lerner index in Panel A and the net interest margin in Panel B. The first subpanel offers falsification tests. The first falsification test assigns interventions to countries that are likely to experience an increase in competition, triggered by a drop in an index that captures activity restrictions, and the second falsification test is based on fake crises, defined as episodes during which a country's banking system experiences contractions in the average bank's capital ratio in three consecutive years. The second subpanel offers standard placebo tests where we pretend that the interventions occurred two years prior to the actual announcement of the intervention. This subpanel also presents a test which drops all EU countries from the sample to rule out that pro-competitive measures by the EU commission drive our key inferences. In the final subpanel, we focus on the correlation between GDP growth as a proxy for demand effects and our two competition measures. We run regressions on the full sample, and also on a subsample which omits recession periods (defined as two consecutive years of contractions of GDP growth) and crisis periods. These regressions only include year dummies and country dummies, all other regressions in this table include the control variables explained in the notes to Table 3, and also country and year dummies. Standard errors clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Lerner index									**Panel B: Net interest margins**							
Subpanel: Falsification tests	*Falsification test (drop in activity restrictions)*				*Falsification test (fake crises)*				*Falsification test (drop in activity restrictions)*				*Falsification test (fake crises)*			
Blanket guarantee	0.025				-0.009				-0.003				0.005			
	(1.65)				(-0.57)				(-0.38)				(0.67)			
Liquidity support		-0.005				-0.000				0.005				0.009		
		(-0.32)				(-0.00)				(0.51)				(0.94)		
Recapitalizations			0.001				-0.020				0.002				0.002	
			(0.08)				(-1.18)				(0.18)				(0.27)	
Nationalizations				-0.001				-0.016				0.001				0.004
				(-0.08)				(-1.09)				(0.11)				(0.51)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	831	831	831	831	1687	1687	1687	1687	831	831	831	831	1687	1687	1687	1687
R2	0.290	0.286	0.286	0.286	0.241	0.241	0.243	0.242	0.643	0.643	0.643	0.643	0.661	0.661	0.661	0.661
Number of interventions	37	37	37	37	60	60	60	60	37	37	37	37	60	60	60	60
Subpanel: Placebo tests and removing EU countries	*Standard placebo regressions*				*Removing EU countries*				*Standard placebo regressions*				*Removing EU countries*			
Blanket guarantee	0.002				-0.039				0.002				-0.014			
	(0.09)				(-1.33)				(0.09)				(-0.33)			
Liquidity support		-0.020				-0.050**				-0.020				-0.046*		
		(-1.03)				(-2.28)				(-1.03)				(-1.81)		
Recapitalizations			-0.027				-0.046*				-0.027				-0.050**	
			(-1.40)				(-1.97)				(-1.40)				(-2.21)	
Nationalizations				-0.025				-0.016				-0.025				-0.061**
				(-1.16)				(-0.65)				(-1.16)				(-2.26)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1644	1644	1644	1644	1425	1425	1425	1425	1644	1644	1644	1644	1425	1425	1425	1425
R2	0.249	0.249	0.249	0.249	0.251	0.254	0.253	0.251	0.673	0.674	0.675	0.674	0.654	0.659	0.660	0.662
Number of interventions	11	34	32	26	8	20	21	18	11	34	32	26	8	20	21	18
Subpanel: Demand effects	*Full sample*				*Sample excluding crisis years and recessions*				*Full sample*				*Sample excluding crisis years and recessions*			
GDP growth	0.157				0.223				-0.087				-0.245			
	(1.14)				(0.84)				(-1.14)				(-0.94)			
Year dummies	Yes				Yes				Yes				Yes			
Country dummies	Yes				Yes				Yes				Yes			
Observations	1687				237				1687				237			
R2	0.231				0.565				0.624				0.778			

Table 6
Long-run effects: Evolution of banking competition over time in response to government interventions

This table presents difference-in-difference regressions for the effect of blanket guarantees, liquidity support, recapitalizations, and nationalizations on the evolution of banking competition over time, measured by the Lerner index and by the net interest margin. To establish the long-run effects of government interventions, we measure competition at *t*+1 in Panel A and B, at *t*+3 in Panel C and D, and at *t*+5 in Panel E and F. The control variables (not shown for brevity) are an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Lerner index (measured at *t+1*)					**Panel B: Net interest margin (measured at *t+1*)**			
Blanket guarantee	-0.027				0.002			
	(-0.99)				(0.06)			
Liquidity support		-0.034*				-0.022		
		(-1.90)				(-1.34)		
Recapitalizations			-0.043**				-0.025	
			(-2.31)				(-1.55)	
Nationalizations				-0.005				-0.040*
				(-0.26)				(-1.80)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1527	1527	1527	1527	1527	1527	1527	1527
R2	0.245	0.247	0.248	0.245	0.651	0.653	0.653	0.655
Number of interventions	9	31	28	23	9	31	28	23
Panel C: Lerner index (measured at *t+3*)					**Panel D: Net interest margin (measured at *t+3*)**			
Blanket guarantee	-0.058**				0.017			
	(-2.19)				(0.44)			
Liquidity support		-0.045**				0.002		
		(-2.18)				(0.13)		
Recapitalizations			-0.073***				-0.022	
			(-3.68)				(-1.14)	
Nationalizations				-0.067***				-0.022
				(-2.91)				(-0.92)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1293	1293	1293	1293	1293	1293	1293	1293
R2	0.259	0.261	0.265	0.263	0.680	0.680	0.681	0.681
Number of interventions	4	24	20	15	4	24	20	15
Panel E: Lerner index (measured at *t+5*)					**Panel F: Net interest margin (measured at *t+5*)**			
Blanket guarantee	-0.088				-0.040***			
	(-1.57)				(-2.96)			
Liquidity support		-0.011				-0.008		
		(-0.30)				(-0.61)		
Recapitalizations			-0.017				-0.037**	
			(-0.46)				(-2.04)	
Nationalizations				-0.066**				-0.039**
				(-2.38)				(-1.98)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1063	1063	1063	1063	1063	1063	1063	1063
R2	0.310	0.307	0.308	0.312	0.691	0.690	0.693	0.692
Number of interventions	3	23	19	14	3	23	19	14

Table 7

Instrumental variable regressions: Effects of government interventions on banking competition

We present two-stage least squares regressions of the effect of blanket guarantees, liquidity support, recapitalizations, and nationalizations on Lerner indices and net interest margins. Panel A shows the results from the second stage, and Panel B shows the first stage. The first stage regressions use linear probability models. We use the same set of instruments for all four government interventions. We use information about the electoral cycle and the political environment. The election year dummy takes on the value one if a parliamentary election takes place in the corresponding year, and we additionally use the time since the last election (in years). Further, we use a dummy that takes on the value of one if the largest government party has a right-wing orientation, and country population (in logs). Also, we use instruments that provide information about the institutional environment: an index that provides information about the prompt corrective power (ranging from 0 to 6) of the regulatory agency in charge of supervising banks. The set of instruments is further complemented by information about the number of bank supervisors with more than 10 years of experience, and data about the budget (in Million USD) of the supervisory agency. We also rely on a dummy variable that takes on the value of one if a neighbouring country with contiguous borders to the country we focus on experienced a banking crisis, and we include a dummy for EU membership. The latter two variables are interacted to consider fears of contagion in Europe. To consider the opacity of bank balance sheets, we use data about securities holdings. Specifically, securities holdings are captured by the ratio of AFS (available for sale) securities to total securities, and HTM (held to maturity) securities to total securities. All regressions include the control variables discussed in the notes to Table 3 (not shown). We present a Hansen test for the exclusion restrictions to test the null that the instruments are valid, i.e., uncorrelated with the error term, and that the instruments are correctly excluded from the estimated equation. An *F*-Test for the joint significance of the excluded instruments is also reported, and we also show Kleibergen-Paap's *F*-Test for weak identification. The null hypothesis is that the instruments are weak. At the bottom of the table, we present the critical values of the Stock and Yogo (2005) *F*-Statistics for a size bias of 10% relative to OLS. Country and year dummies included. Standard errors clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Instrumental variable estimator 2nd stage

Dependent variable	*Lerner index*				*Net interest margin*			
Government interventions								
Blanket guarantee	-0.022				-0.040			
	(-0.44)				(-1.24)			
Liquidity support		-0.102*				-0.0803**		
		(-1.79)				(-2.42)		
Recapitalizations			-0.0974*				-0.102***	
			(-1.71)				(-2.78)	
Nationalizations				-0.0579				-0.0955**
				(-1.07)				(-2.25)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	929	929	929	929	929	929	929	929
R2	0.065	0.040	0.047	0.050	0.289	0.183	0.168	0.197
Hansen *J*-Statistic	10.35	7.637	9.021	8.983	21.03	16.19	14.77	19.43
Hansen *p*-value	0.499	0.745	0.620	0.623	0.0330	0.134	0.193	0.0537

Panel B: Instrumental variable estimator 1st stage

Dependent variable	*Blanket guarantees*	*Liquidity support*	*Recapitalizations*	*Nationalizations*
Instruments				
Election year	-0.029*	-0.060***	-0.053***	-0.030
	(-1.77)	(-3.11)	(-2.68)	(-1.67)
Time since last election (years)	-0.011*	-0.037***	-0.026***	-0.015**
	(-1.83)	(-4.15)	(-3.28)	(-2.03)
Government party with right-wing orientation	-0.019	-0.007	-0.004	-0.046**
	(-1.04)	(-0.28)	(-0.18)	(-2.14)
Population (log)	0.059	-0.726**	-1.103***	-1.009***
	(0.27)	(-2.07)	(-3.15)	(-2.83)
Prompt corrective power	0.008*	0.000	0.005	0.008
	(1.92)	(0.02)	(0.71)	(1.25)
Bank supervisors > 10 years of experience	-0.000	0.001	0.001	-0.002
	(-1.02)	(0.79)	(0.65)	(-1.63)
Budget for supervision	-0.000	0.001***	0.001***	0.001***
	(-1.09)	(3.64)	(3.52)	(2.96)
EU member country	-0.052**	-0.110**	-0.142***	-0.129***
	(-2.07)	(-2.09)	(-2.77)	(-2.99)
Contiguous country with crisis	-0.000	-0.030	-0.009	-0.002
	(-0.01)	(-0.88)	(-0.25)	(-0.05)
EU member country × Contiguous country with crisis	-0.000	0.165**	0.006	0.080
	(-0.00)	(2.08)	(0.11)	(1.08)
AFS securities/Total securities	-0.002***	-0.001	-0.002***	-0.002***
	(-3.61)	(-1.59)	(-2.66)	(-2.99)
HTM securities/Total securities	0.042***	0.019***	0.020***	0.024***
	(6.59)	(3.67)	(3.81)	(4.78)
Control variables	Yes	Yes	Yes	Yes
Observations	929	929	929	929
R2	0.328	0.513	0.496	0.428
Number of interventions	6	22	20	15
First stage *F*-Test (instruments)	21.18	16.35	14.66	18.66
Kleibergen-Paap weak identification *F*-Statistic	21.20	16.37	14.68	18.68
Stock and Yogo (2005) maximal IV relative bias 10 %	11.52	11.52	11.52	11.52

Table 8

Heckman selection models: Effects of government interventions on banking competition

This table presents two-step Heckman selection models that evaluate in the first step the occurrence of a banking crisis (or zero otherwise) and establish in the second step the effect of blanket guarantees, liquidity support, recapitalizations, and nationalizations on competition, measured by the Lerner index in Panel A, and by the net interest margin in Panel B. As identifying covariates that determine the occurrence of banking crises, we use the ratio of M2 to foreign reserves to evaluate a country's propensity to suffer sudden capital outflows, and real credit growth. Since the first stage for the occurrence of a banking crisis is identical across the four regressions for the effects of government interventions, we only report it once per panel. The vector of control variables (not shown for brevity) that enters both the first and the second stage consists of an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Robust *t*-statistics in parentheses. Country and year dummies included. Standard errors are clustered on the country level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

	Panel A: Lerner index					**Panel B: Net interest margin**				
	1st stage	*2nd stage*				*1st stage*	*2nd stage*			
Dependent variable	*Banking crisis*	*Competition (Lerner index)*				*Banking crisis*	*Competition (Net interest margin)*			
M2/Foreign reserves	0.014***					0.014***				
	(3.30)					(3.30)				
Real credit growth (*t*-1)	2.517***					2.517***				
	(4.39)					(4.39)				
Blanket guarantee		-11.274***					-9.708***			
		(-2.87)					(-11.59)			
Liquidity support			-0.410**					-0.414***		
			(-2.31)					(-10.95)		
Recapitalizations				-8.505**					-8.578***	
				(2.31)					(-10.95)	
Nationalizations					-0.192					-0.131***
					(-1.63)					(-5.81)
Inverse Mills ratio		0.014	0.014	0.014	0.016		0.001	0.001	0.001	0.001
		(0.62)	(0.62)	(0.62)	(0.71)		(0.04)	(0.04)	(0.04)	(0.34)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673
Number of interventions	n/a	11	34	32	25	n/a	11	34	32	25

Table 9
Extensions: Effects of government interventions on zombie banks

This table investigates the effect of blanket guarantees, liquidity support, recapitalizations, and nationalizations on the presence of zombie banks, measured by the deposit and loan market share of zombie banks. The table presents tests for a measure of zombie banks based on book values of capital and of market values of capital. Our definition of zombie banks based on book values considers a bank to be a zombie bank if it has a negative tangible capital ratio. Tangible capital equals common equity minus intangible assets. Intangible assets comprise good will, other intangibles, and deferred tax assets. We define a bank as a zombie bank based on market values if the market value of common equity and preferred shares is below the value of liabilities. The sample using market based measures of zombie banks is substantially reduced because only 2,138 banks of the 21,988 banks in the sample are publicly listed. Panel A presents regressions where the deposit market share is the dependent variable, and Panel B presents such regressions for the effect on zombie banks' loan market shares. Panel C and D replicate these regressions but constrain the sample to countries that experienced a banking crisis. Panel E and Panel F show how the frequency of government interventions in a country correlates with the evolution of the market shares of zombie banks in deposit and loan markets, respectively. Panel G presents the change in the competition measures per quartile and the corresponding proportion of zombie banks' market shares in deposit markets, and Panel H shows these analyses for loan markets. All regressions include the control variables (not shown) discussed in the notes to Table 3. Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Deposit market share of zombie banks (Full sample)									**Panel B: Loan market share of zombie banks (Full sample)**							
Zombie bank measure based on	*Book value*				*Market value*				*Book value of capital*				*Market value of capital*			
Blanket guarantee	-0.004				0.032				-0.005				-0.028			
	(-0.15)				(0.29)				(-0.19)				(-0.25)			
Liquidity support		0.022				0.102				0.028				0.099		
		(1.38)				(1.35)				(1.45)				(1.38)		
Recapitalizations			0.021				0.115				0.027				0.106	
			(1.26)				(1.49)				(1.37)				(1.41)	
Nationalizations				0.012				0.120				0.014				0.146
				(0.70)				(1.27)				(0.73)				(1.62)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1528	1528	1528	1528	257	257	257	257	1528	1528	1528	1528	257	257	257	257
R2	0.249	0.252	0.251	0.250	0.828	0.807	0.808	0.807	0.244	0.247	0.247	0.245	0.827	0.805	0.806	0.809
Number of interventions	9	30	28	23	3	14	12	9	9	30	28	23	3	14	12	9
Panel C: Deposit market share of zombie banks (Crisis countries only)									**Panel D: Loan market share of zombie banks (Crisis countries only)**							
Zombie bank measure based on	*Book value*				*Market value*				*Book value of capital*				*Market value of capital*			
Blanket guarantee	-0.001				0.072				-0.004				0.008			
	(-0.03)				(0.84)				(-0.13)				(0.09)			
Liquidity support		0.035**				0.177				0.038*				0.159		
		(2.10)				(1.67)				(1.84)				(1.59)		
Recapitalizations			0.028*				0.174*				0.034*				0.150	
			(1.94)				(1.83)				(1.79)				(1.66)	
Nationalizations				0.008				0.151				0.007				0.172*
				(0.60)				(1.51)				(0.44)				(1.82)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	479	479	479	479	135	135	135	135	479	479	479	479	135	135	135	135
R2	0.407	0.414	0.412	0.408	0.853	0.806	0.807	0.801	0.399	0.406	0.405	0.399	0.821	0.773	0.772	0.777
Number of interventions	9	30	28	23	3	14	12	9	9	30	28	23	3	14	12	9

Panel E: Frequency of interventions and the deposit market share of zombie banks		**Panel F: Frequency of interventions and the loan market share of zombie banks**	
Zombie bank measure based on	*Book value*	*Market value*	*Book value*	*Market value*
1	0.021	0.032	0.020	0.030
2	0.067	0.045	0.089	0.041
3	0.096	0.048	0.104	0.046
4	0.166	0.048	0.164	0.038

Panel G: Magnitude of change in competition and deposit market share of zombie banks							**Panel H: Magnitude of change in competition and loan market share of zombie banks**			
ΔLerner index	**ΔNet interest margin**	**Lerner index**		**Net interest margin**			**Lerner index**		**Net interest margin**	
Zombie bank measure based on		*Book value*	*Market value*	*Book value*	*Market value*		*Book value*	*Market value*	*Book value*	*Market value*
25th	-0.133	-0.045	0.121	0.047	0.153	0.047	0.129	0.041	0.166	0.044
50th	-0.026	-0.002	0.155	0.043	0.083	0.047	0.164	0.043	0.087	0.044
75th	0.007	0.001	0.080	0.049	0.096	0.044	0.076	0.045	0.095	0.043

Table 10
Pricing effects: Deposit and loan rates and government interventions

The table presents difference-in-difference regressions of the effect of blanket guarantees, liquidity support, recapitalizations, and nationalizations on average deposit rates in Panel A, and on average loan rates in Panel B. Panel C and D replicate these tests but omit years where zombie banks (based on book values of bank equity) are present, and Panel E and F constrain the sample to countries where zombie banks (based on book values of equity) are present at least during one year. In all regressions, we include the following control variables (not shown): an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in as % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Deposit rates (Full sample)					**Panel B: Loan rates (Full sample)**			
Blanket guarantee	-0.088				-0.053			
	(-1.66)				(-1.53)			
Liquidity support		-0.048**				-0.051**		
		(-2.32)				(-2.19)		
Recapitalizations			-0.041*				-0.049**	
			(-1.78)				(-2.08)	
Nationalizations				-0.057**				-0.067**
				(-2.29)				(-2.51)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687	1687	1687	1687	1687
R2	0.916	0.916	0.916	0.916	0.916	0.917	0.917	0.917
Number of interventions	11	34	32	26	11	34	32	26
Panel C: Deposit rates (Years with zombie bank presence omitted)					**Panel D: Loan rates (Years with zombie bank presence omitted)**			
Blanket guarantee	-0.053				-0.040			
	(-1.50)				(-1.24)			
Liquidity support		-0.033*				-0.042*		
		(-1.84)				(-1.89)		
Recapitalizations			-0.022				-0.031	
			(-1.25)				(-1.62)	
Nationalizations				-0.039*				-0.045*
				(-1.90)				(-1.73)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1463	1463	1463	1463	1463	1463	1463	1463
R2	0.921	0.921	0.921	0.921	0.922	0.922	0.922	0.922
Number of interventions	7	22	21	18	7	22	21	18
Panel E: Deposit rates (Countries with at least one year of zombie banks)					**Panel F: Loan rates (Countries with at least one year of zombie banks)**			
Blanket guarantee	-0.102*				-0.054			
	(-1.70)				(-1.37)			
Liquidity support		-0.054**				-0.056**		
		(-2.25)				(-2.34)		
Recapitalizations			-0.060**				-0.067**	
			(-2.17)				(-2.41)	
Nationalizations				-0.072**				-0.086***
				(-2.11)				(-2.81)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	874	874	874	874	874	874	874	874
R2	0.945	0.944	0.945	0.945	0.931	0.932	0.933	0.934
Number of interventions	10	24	22	17	10	24	22	17

Table 11
Pricing effects: Alternative explanations

The table presents tests to address alternative explanations for the pricing effects shown in Table 10. Panel A shows *t*-test for differences in means in deposits and money market funding three years prior to and three years following the announcement of blanket guarantees, liquidity support, recapitalizations, and nationalizations to establish whether inflows of funds differ for these sub-periods. Panel B runs the difference-in-difference regressions for deposit and loan rates as shown in Table 10 but we now omit countries in which deposit insurance coverage levels increased between 2007 and 2010. In Panel C, we present regressions with the setup identical to those presented in Table 10, except for the fact that we exclude country-year observations where the government owns a large proportion of the banking system, defined as government ownership exceeding the 75th percentile of the government ownership variable. The control variables in Panel B and Panel C are an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Deposit volumes	*Blanket guarantee*			*Liquidity support*			*Recapitalization*			*Nationalization*		
	Before	*After*	*t-test*	*Before*	*After*	*t-test*	*Before*	*After*	*t-test*	*Before*	*After*	*t-test*
Deposits and money market funding	3,299,749	3,503,309	-0.08	1,681,823	1,915,002	-0.30	2,103,197	2,312,124	-0.24	2,308,503	2,527,478	-0.19

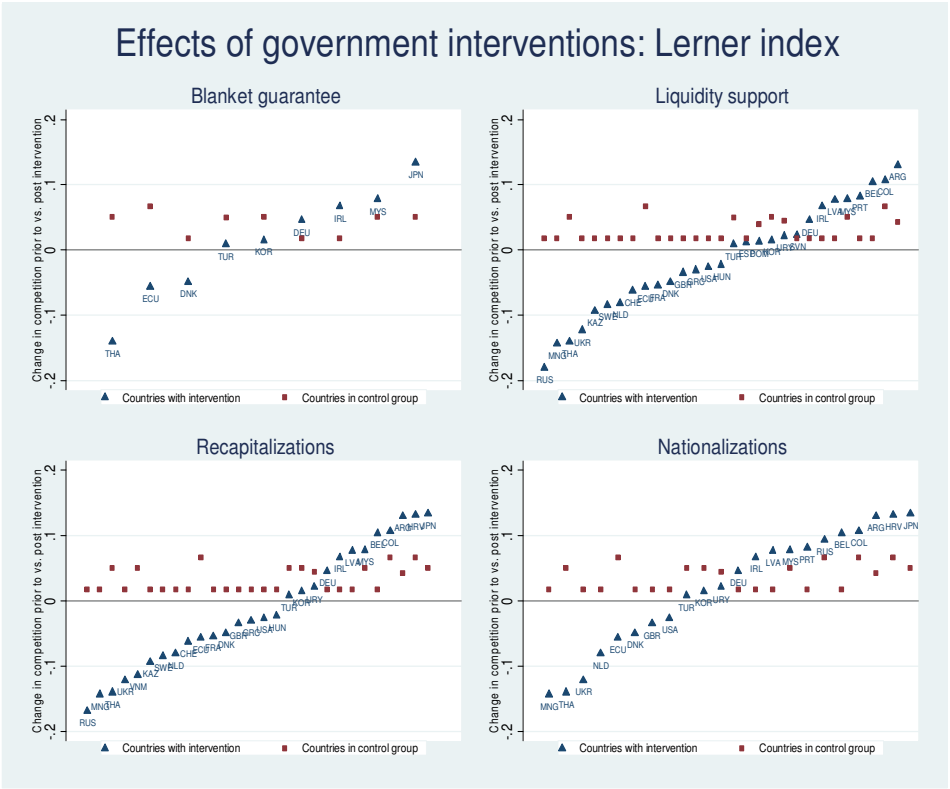
Panel B: Pricing effects – countries with increases in deposit insurance coverage limit removed								
	Deposit rates				*Loan rates*			
Blanket guarantee	-0.139*				-0.081*			
	(-1.94)				(-1.69)			
Liquidity support		-0.076**				-0.089**		
		(-2.22)				(-2.36)		
Recapitalizations			-0.060*				-0.076**	
			(-1.71)				(-2.14)	
Nationalizations				-0.088**				-0.112***
				(-2.31)				(-2.90)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1410	1410	1410	1410	1410	1410	1410	1410
R2	0.916	0.916	0.915	0.916	0.914	0.915	0.915	0.916
Number of interventions	8	19	20	17	8	19	20	17

Panel C: Pricing effects – countries with large government ownership of the banking system removed								
	Deposit rates				*Loan rates*			
Blanket guarantee	-0.054				-0.062			
	(-1.12)				(-1.07)			
Liquidity support		-0.037				-0.044*		
		(-1.65)				(-1.74)		
Recapitalizations			-0.037				-0.053*	
			(-1.44)				(-1.90)	
Nationalizations				-0.041*				-0.057*
				(-1.67)				(-1.96)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1258	1258	1258	1258	1258	1258	1258	1258
R2	0.924	0.924	0.924	0.924	0.931	0.931	0.931	0.931
Number of interventions	5	23	22	15	5	23	22	15

Figure 1

Effects of government interventions on Lerner indices and net interest margins

Figure 1 illustrates the change in the competition measure for countries that announced blanket guarantees, liquidity support, recapitalizations, and nationalizations and the corresponding change for countries in the control group over the same period. The panel on the left hand side uses the Lerner index as a competition measure, and the panel on the right hand side uses the net interest margin as a measure of competition. Each subpanel illustrates the effect of the respective government action. Countries with interventions are represented by a triangle, and countries in the control group are depicted by a square. All countries whose ISO codes are printed below the zero line experience contractions in Lerner indices and net interest margins. The diagrams sort the countries on the Y-axis from the greatest contraction in the competition measure on the left to the largest increase in the competition measure on the right hand side.



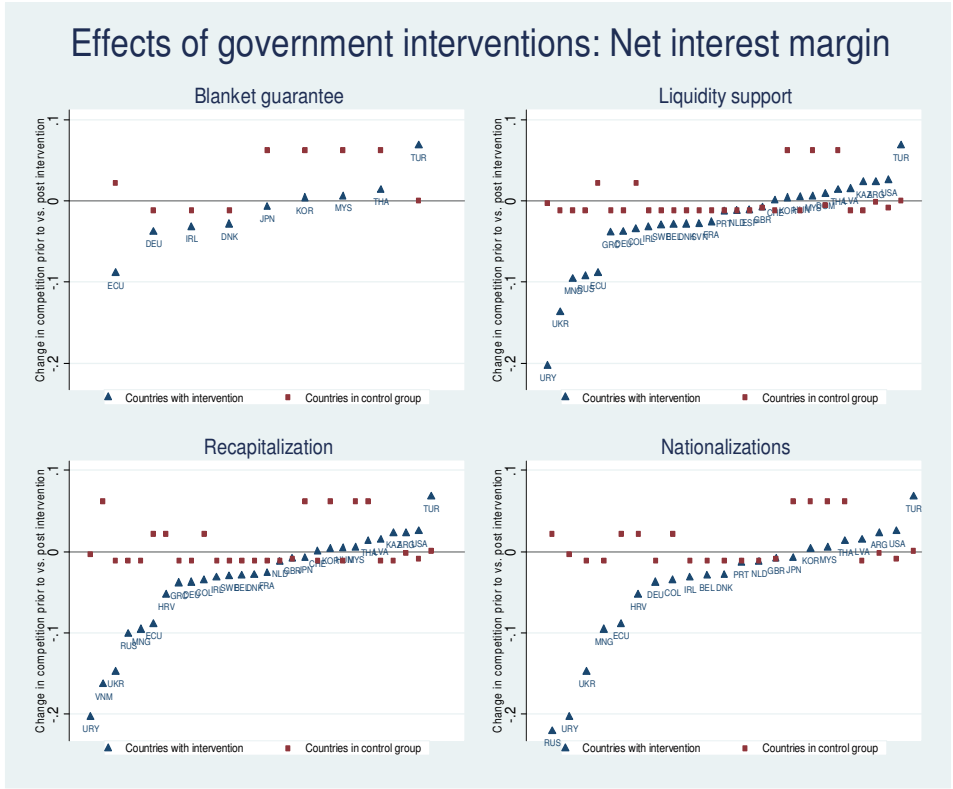


Figure 2

Parallel trends: Behavior of competition measures prior to government interventions

Figure 2 illustrates the behavior of annual changes of Lerner indices and net interest margins in the three years prior to the government interventions (blanket guarantees, liquidity support, recapitalizations, and nationalizations). Each panel shows the behavior of competition prior to the respective government action. Countries with interventions are represented by a triangle, and countries in the control group are depicted by a square.

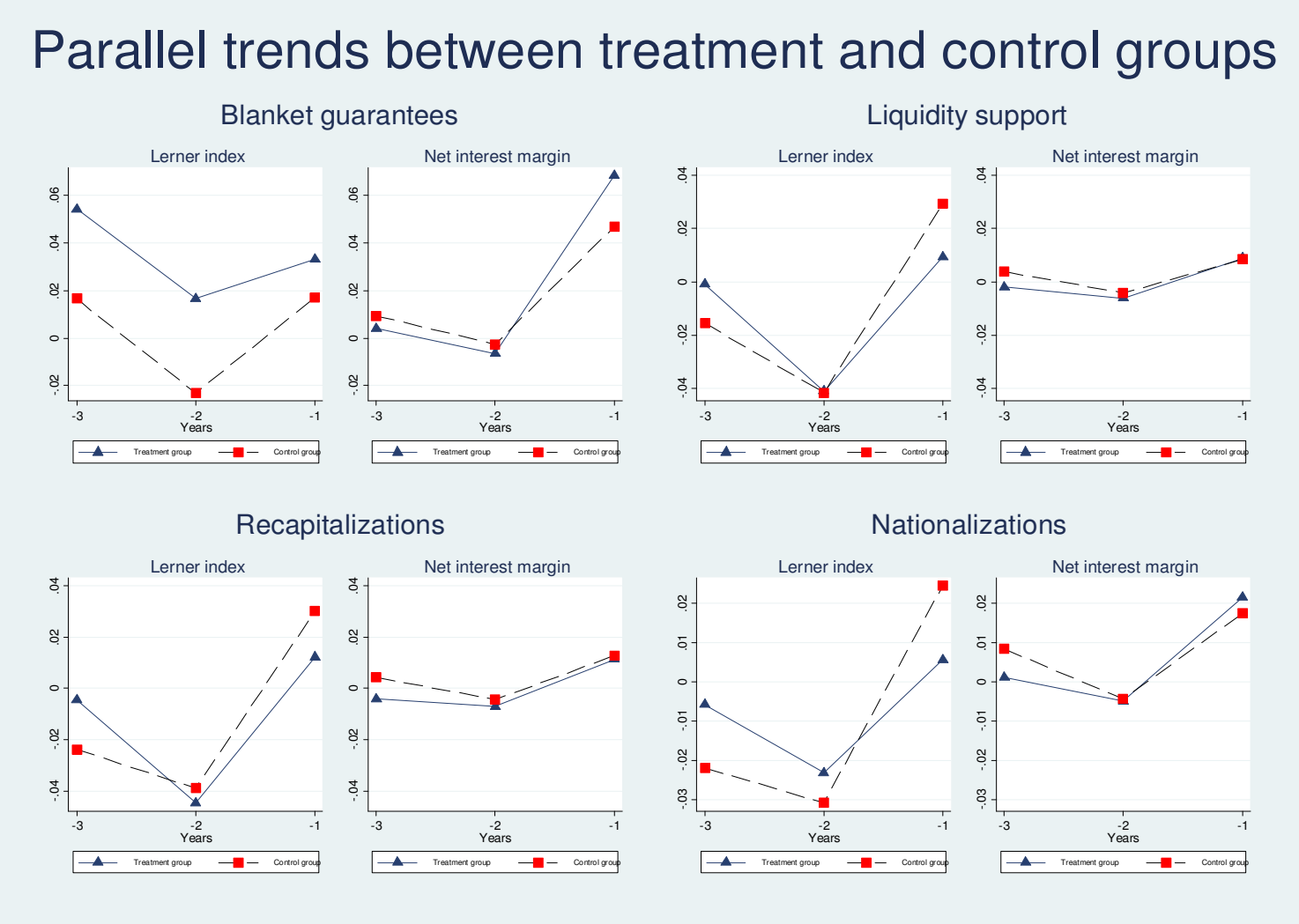


Figure 3
Long-run effects of government interventions on competition

Figure 3 illustrates the evolution of Lerner indices and net interest margins following blanket guarantees, liquidity support, recapitalizations, and nationalizations in the long run in the treatment countries. The dark bars show competition in the year the government intervention was announced, and the light bars illustrate the evolution during the five subsequent years. For countries that experience interventions after 2005, we only observe the competition measures in the remaining years of the sample period.

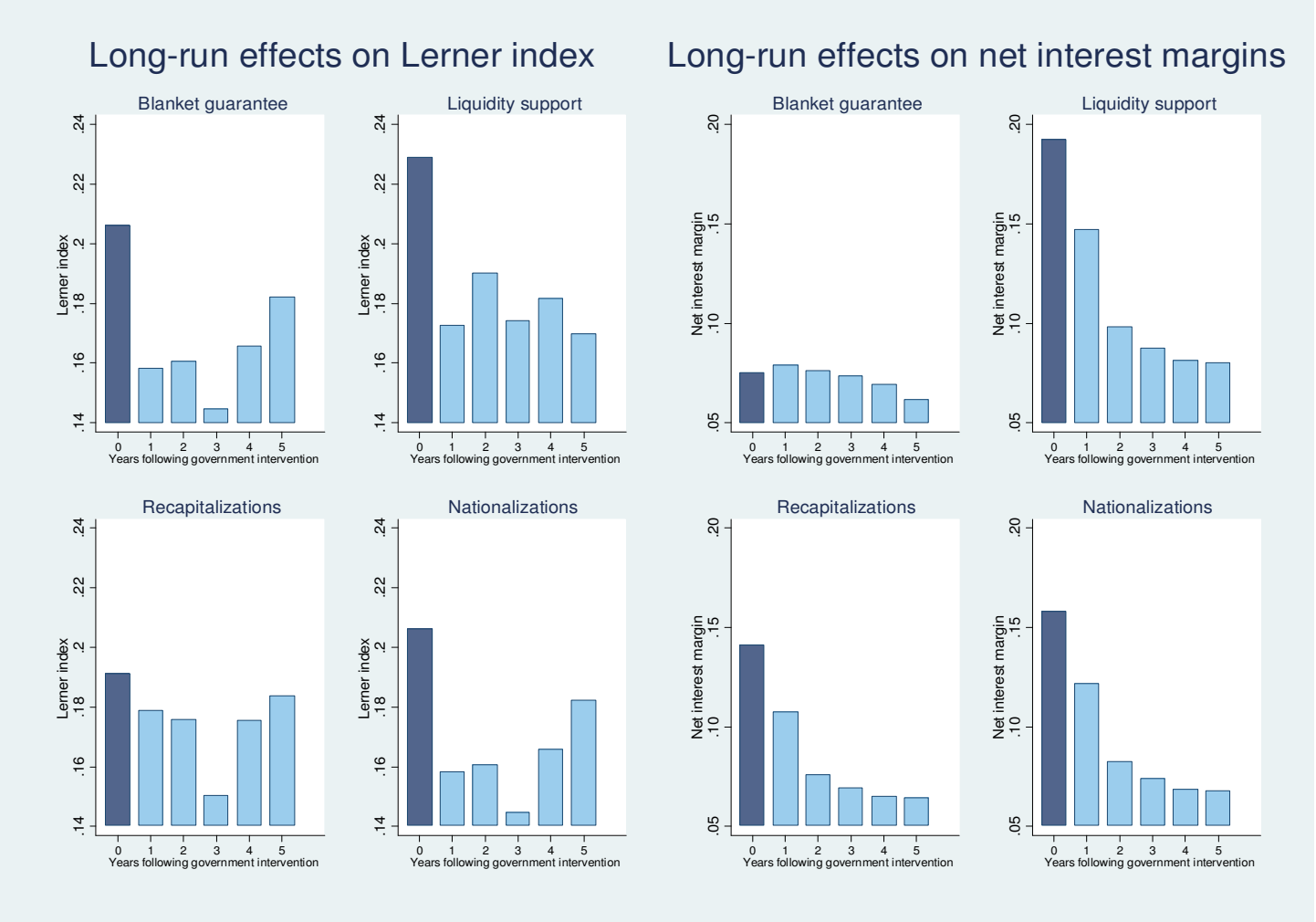
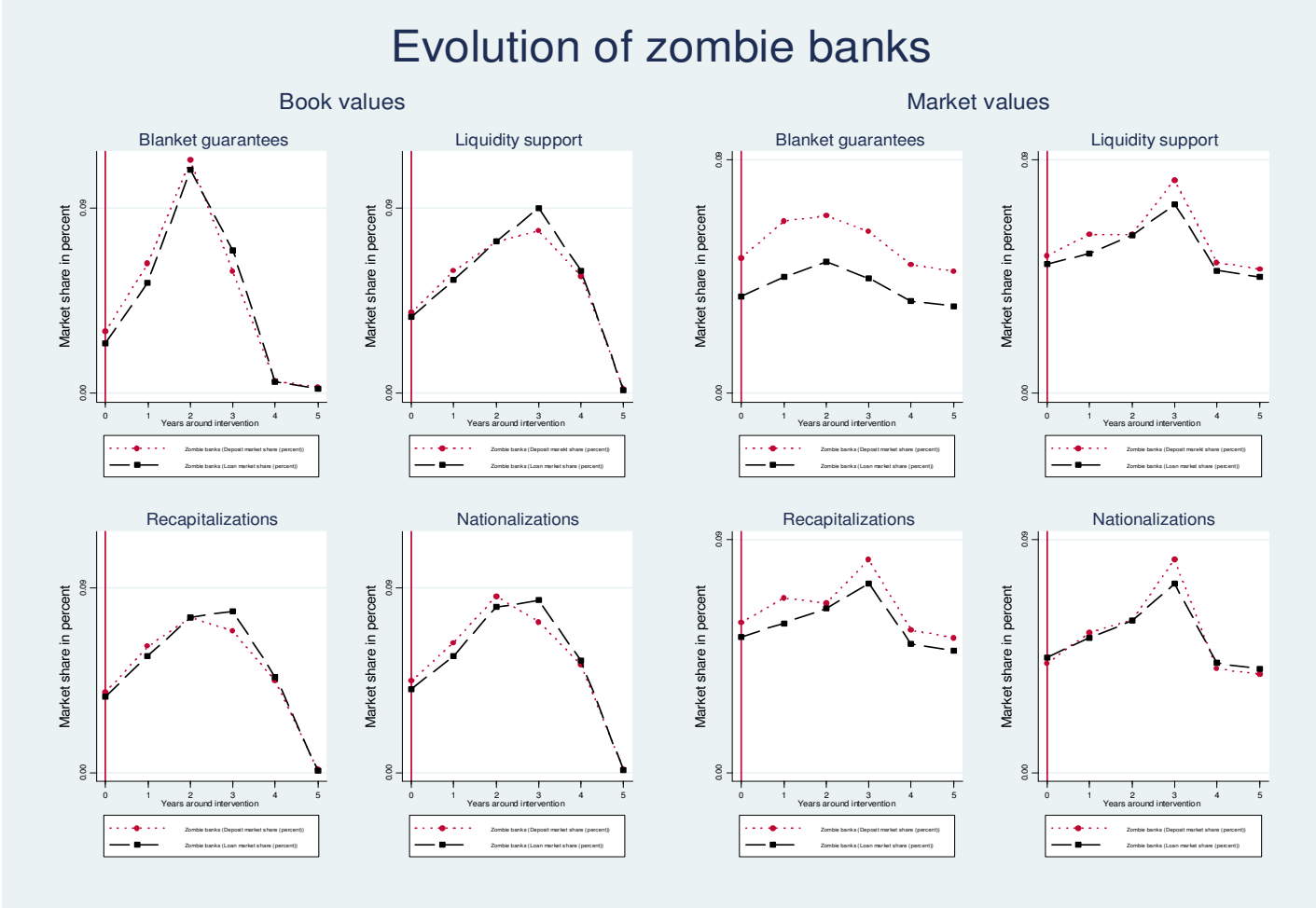


Figure 4
Evolution of zombie banks

Figure 4 illustrates the evolution of zombie banks in countries that announced blanket guarantees, liquidity support, recapitalizations, and nationalizations. We present the information for the announcement year and the 5 years following the announcement. Each panel demonstrates the evolution of zombie banks' market shares in terms of deposits, depicted by a circle, and in terms of loans, depicted by a square. The panels show results based on book values of capital and of market values (common equity and preferred shares) of capital. Using book values, we define zombie banks as banks with negative tangible capital ratios. Tangible capital equals common equity minus intangible assets. Intangible assets comprise good will, other intangibles, and deferred tax assets. We define a zombie bank based on market values if the value of the bank's liabilities exceeds the market value of common equity and preferred shares.



Supplementary Appendix

The effects of government interventions in the financial sector on banking competition and the evolution of zombie banks

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Supplementary Appendix Table A.1
Crises and government interventions

The table provides in Panel A an overview about countries with banking crises, based on the classification in Laeven and Valencia (2010, 2013) and information from WEO. We also report the government responses to these crises. Countries market with * are borderline crises. In the United States, the † indicates that the crisis started in 2007 but only became systemic in 2008 with deployment of government interventions in 2008. Panel B shows the time distribution of the government interventions, and Panel C reports on the frequency of government interventions per country.

Panel A: Overview

Country (ISO code)	**Crisis**		**Government interventions**			
	Start	*End*	*Blanket guarantee*	*Liquidity support*	*Recapitalization*	*Nationalization*
Argentina (ARG)	2001	2003		2001	2001	2001
Austria (AUT)	2008	-		2008	2008	2008
Belgium (BEL)	2008	-		2008	2008	2008
Bulgaria (BGR)	1996	1997		1996	1996	1996
China (CHN)	1998	1998				
Colombia (COL)	1998	2000		1998	1998	1998
Croatia (HRV)	1998	1999			1998	1998
Czech Republic* (CZE)	1996	2000			1996	
Denmark (DNK)	2008	-	2008	2008	2008	2008
Dominican Republic (DOM)	2003	2004		2003		
Ecuador (ECU)	1998	2002	1998	1998	1998	1998
France* (FRA)	2008	-		2008	2008	
Germany (DEU)	2008	-	2008	2008	2008	2008
Greece* (GRC)	2008	-		2008	2008	
Hungary* (HUN)	2008	-		2008	2008	
Iceland (ISL)	2008	-				
Indonesia (IDN)	1997	2001	1997	1997	1997	1997
Ireland (IRL)	2008	-	2008	2008	2008	2008
Jamaica (JAM)	1996	1998	1996	1996	1996	1996
Japan (JPN)	1997	2001	1997		1997	1997
Kazakhstan* (KAZ)	2008	-		2008	2008	
Korea (KOR)	1997	1998	1997	1997	1997	1997
Latvia (LVA)	2008	-		2008	2008	2008
Luxembourg (LUX)	2008	-		2008	2008	2008
Malaysia (MYS)	1997	1999	1997	1997	1997	1997
Mongolia (MNG)	2008	-		2008	2008	2008
Netherlands (NLD)	2008	-		2008	2008	2008
Philippines (PHL)	1997	2001				
Portugal* (PRT)	2008	-		2008		2008
Russian Federation (RUS)	1998	1998		1998		1998
Russian Federation* (RUS)	2008	-		2008	2008	
Slovak Republic (SVK)	1998	2002				
Slovenia* (SVN)	2008	-		2008		
Spain* (ESP)	2008	-		2008		
Sweden* (SWE)	2008	-		2008	2008	
Switzerland* (CHE)	2008	-		2008	2008	
Thailand (THA)	1997	2000	1997	1997	1997	1997
Turkey (TUR)	2000	2001	2000	2000	2000	2000
Ukraine (UKR)	1998	1999		1998		
Ukraine (UKR)	2008	-		2008	2008	2008
United Kingdom (GBR)	2007	-		2007	2007	2007
United States (USA)†	2007	-		2008	2008	2008
Uruguay (URY)	2002	2005		2002	2002	2002
Vietnam (VNM)	1997	1997			2002	

Panel B: Time distribution

		Government interventions			
Number of countries with crises		*Blanket guarantee*	*Liquidity support*	*Recapitalization*	*Nationalization*
1996	3	1	2	3	2
1997	9	5	4	6	5
1998	13	1	4	3	4
1999	10	0	0	0	0
2000	9	1	1	1	1
2001	7	0	1	1	1
2002	4	0	1	1	1
2003	3	0	1	0	0
2004	1	0	0	0	0
2005	1	0	0	0	0
2006	0	0	0	0	0
2007	2	0	2	2	2
2008	20	3	18	15	9
2009	21	0	0	0	0
2010	21	0	0	0	0

Panel C: Frequency of interventions

	Number of government interventions			
Government interventions per country	*1*	*2*	*3*	*4*
% of countries with multiple interventions	13.51	24.95	31.89	29.64

Supplementary Appendix Table A.2
Bank level evidence for the effect of recapitalizations and nationalizations

We report panel data models for the effect of recapitalizations and nationalizations on Lerner indices in Panel A and net interest margins on the bank level in Panel B using manually collected information on recapitalizations and nationalizations. The information on recapitalizations and nationalizations only covers the recent crisis from 2007 onwards. Banks that receive capital injections or are nationalized are matched with observationally similar banks from the same country, the same year, and from the same bank type (commercial, savings, or cooperative bank). Additionally, we impose the criterion that the banks from the control group are similar in terms of size based on being in the same size quartile of the distribution of total assets to compare banks that are equivalent in terms of scope and scale of business activities. If multiple banks serve as a match for a treatment bank, we restrict the number of matches to a maximum of 5 banks in the control group. Our control variables are identical to the control variables used in the regressions on the aggregate (i.e., country) level. We include an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). On the bank level, we use the ratio of loan impairment charges to gross loans, and total assets (ln) as further control variables. We also include bank and year fixed effects, and run specifications which additionally include an interaction term of country fixed effects with year fixed effects. Standard errors are clustered at the bank level. Since different countries revert to different types of bailouts, we use for recapitalizations and nationalizations two different samples. We present the countries that are included in the two different samples at the bottom of the table. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Panel A: Lerner index					**Panel B: Net interest margin**			
Recapitalization	-0.034*	-0.033*			-0.052**	-0.054**		
	(-1.95)	(-1.82)			(-2.03)	(-1.99)		
Nationalization			-0.084*	-0.104*			0.002	0.001
			(-1.86)	(-1.87)			(0.31)	(0.15)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects × Year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	7023	7023	890	890	7023	7023	890	890
R2	0.160	0.173	0.172	0.330	0.050	0.050	0.104	0.216
Number of interventions	589	589	26	26	589	589	26	26
Countries included	*Austria, Belgium, Germany, France, Greece, Ireland, Luxembourg, Netherlands, United Kingdom, United States*		*Austria, Belgium, Denmark, Germany, Iceland, Ireland, Kazakhstan, Latvia, Luxembourg, Mongolia, Netherlands, Portugal, Ukraine, United Kingdom*		*Austria, Belgium, Germany, France, Greece, Ireland, Luxembourg, Netherlands, United Kingdom, United States*		*Austria, Belgium, Denmark, Germany, Iceland, Ireland, Kazakhstan, Latvia, Luxembourg, Mongolia, Netherlands, Portugal, Ukraine, United Kingdom*	

Supplementary Appendix A.3
Computation of the Lerner index

The Lerner index is a widely used measure of banking competition. We follow Anginer, Demirgüç-Kunt, and Zhu (2014) for the computation of the index to capture the degree of market power of a bank by calculating the divergence between product prices and marginal costs of production. The mark-up of output prices over marginal cost is

$$L_{kt} = \frac{p_{kt} - mc_{kt}}{p_{kt}} \tag{A.1}$$

where p_{kt} denotes output prices of bank k at time t (total revenue, interest and non-interest, divided by total assets) and mc_{kt} is the marginal cost obtained by differentiating a translog cost function with respect to total assets Q. We estimate the following translog cost function

$$\ln(C_{kt}) = \alpha_k + \sum_{i=1}^{2} \beta_i \ln(Q_{kt})^i + \sum_{i=1}^{3} \gamma_i \ln(Z_{i,kt}) + \sum_{i=1}^{3} \delta_i \frac{\ln(Q_{kt})\ln(Z_{i,kt})}{2} + \sum_{i=1}^{3}\sum_{j=1}^{3} \delta_{ij} \frac{\ln(Z_{i,kt})\ln(Z_{j,kt})}{2} + \\ + \lambda_1 \tau_t + \lambda_2 \tau_t^2 + \lambda_3 \tau_t \ln(Q_{kt}) + \lambda_4 \tau_t \ln(Z_{1,kt}) + \lambda_5 \tau_t \ln(Z_{2,kt}) + \lambda_6 \tau_t \ln(Z_{3,kt}) + \xi_{kt} + \mu_k \tag{A.2}$$

where C is total costs (the sum of interest expenses, commission and fee expenses, trading expenses, personnel expenses, and other administrative and operating expenses), Q represents total assets, Z_1 is the ratio of interest expenses to total deposits and money market funding (*proxy* for input price of deposits), Z_2 is the ratio of personal expenses to total assets (*proxy* for input price of labor), and Z_3 is the ratio of other operating and administrative expenses to total assets (*proxy* for input price of equipment/fixed capital). All these variables enter the regression in logs. The term μ_k denotes bank level fixed effects. The cost equation specified above includes trend terms τ that capture cost-reducing technological changes over time. The estimation of the cost function in (A.2) is undertaken under the restrictions of symmetry and linear homogeneity in the price of inputs. Note that the results do not change if these constraints are lifted. The Lerner index, L, takes values between 0 and 1, whereby higher values indicate more market power (and, hence, less competition). Calculation of the Lerner index is based on data for all commercial, savings, and cooperative banks for the years 1996–2010. The

bank data are obtained from BankScope. In total, 181,830 bank-year observations for 21,988 banks in 124 countries are used to compute the index.

Summary statistics

The table presents the number of observations, means, and standard deviations for the variables used to calculate the Lerner index. All bank level data are obtained from BankScope.

Variable	*Observations*	*Mean*	*S.D.*	*Min*	*Max*
Total assets (ln)	181,830	5.716	2.196	-4.900	19.469
Total costs (ln)	181,830	2.779	2.156	-7.301	16.754
Interest expenses/Total deposits, money market and short-term funding (ln)	181,830	-3.634	0.800	-11.838	3.399
Personal expenses/Total assets (ln)	181,830	-4.260	0.579	-11.415	-0.452
Operating and administrative expenses/Total assets (ln)	181,830	-4.390	0.693	-11.331	0.372

Supplementary Appendix Table A.4
Regressions with additional control variables for expansionary monetary policy and increases in public debt during crises

This table presents additional difference-in-difference regressions for the effect of blanket guarantees, liquidity support, recapitalizations, and nationalizations on competition, measured by the Lerner index in Panel A, and by the net interest margin in Panel B. The regressions include two additional control variables: a variable that measures monetary expansion, defined as the change in the monetary base (M0) between its peak during the crisis and its level one year prior to the crisis, expressed in % of GDP, and a variable that captures increases in public debt in % of GDP, measured over [*t*-1, *t*+3], where *t* is the starting year of the crisis. For the 2007-2009 crises, it is computed as the difference between pre- and post-crisis debt projections. The other control variables (not shown for brevity) are an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Lerner index					**Panel B: Net interest margin**			
Monetary expansion	-0.002	-0.001	-0.002	-0.002	-0.001	0.000	-0.001	-0.001
	(-0.76)	(-0.33)	(-0.63)	(-0.72)	(-0.59)	(0.09)	(-0.43)	(-0.59)
Increase in public debt	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.50)	(-0.57)	(-0.61)	(-0.58)	(-0.62)	(-0.66)	(-0.73)	(-0.44)
Blanket guarantee	-0.024				-0.013			
	(-0.96)				(-0.52)			
Liquidity support		-0.031*				-0.028*		
		(-1.85)				(-1.84)		
Recapitalizations			-0.038**				-0.034**	
			(-2.11)				(-2.24)	
Nationalizations				0.000				-0.039**
				(0.01)				(-2.09)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687	1687	1687	1687	1687
R2	0.242	0.244	0.244	0.242	0.661	0.664	0.665	0.665
Number of interventions	11	34	32	26	11	34	32	26

Supplementary Appendix Table A.5

Effect of government interventions and assisted mergers on banking system concentration

This table presents difference-in-difference regressions for the effect of blanket guarantees, liquidity support, recapitalizations, nationalizations, and, importantly, of assisted mergers on concentration in banking systems, measured by the Herfindahl-Hirschman index. The key variable of interest is the dummy variable that takes on the value of one if a country used assisted mergers to resolve distressed institutions or zero otherwise. The control variables (not shown for brevity) are banking system size, measured by the natural logarithm of banking system assets, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Robust *t*-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Country and year dummies included. Standard errors are clustered on the country level.

Dependent variable	Concentration (HHI)	Concentration (HHI)	Concentration (HHI)	Concentration (HHI)
Assisted merger	-0.036	-0.040	-0.043	-0.050
	(-0.85)	(-0.96)	(-1.04)	(-1.15)
Blanket guarantee	-0.026			
	(-0.52)			
Liquidity support		-0.010		
		(-0.29)		
Recapitalizations			0.012	
			(0.34)	
Nationalizations				0.041
				(1.05)
Control variables	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687
R-squared	0.547	0.547	0.547	0.548
Number of interventions	11	34	32	26

Supplementary Appendix Table A.6
Additional robustness tests

We present additional tests. The first test in the first subpanel clusters standard errors by year. The second test in the first subpanel includes an additional control variable which takes on the value of one if a country also set up asset management companies and restructuring agencies which assume distressed bank assets. In the second subpanel we account for the too-big-to-fail (TBTF) and the too-many-to-fail (TMTF) effects. We consider the too-big-to-fail effect by removing countries whose HHI lies above the 95th percentile of the distribution of the concentration variable, and we account for the too-many-to-fail effect by excluding countries whose total capital ratio is below the 5th percentile of the capital ratio. The third subpanel removes high income economies and emerging markets. The fourth subpanel uses regression weights where we use the inverse of the number of interventions as a weight to assign less importance to countries with multiple interventions. The last test additionally includes a dummy variable for the year during the onset of the crisis. All regressions contain the control variables discussed in the notes to Table 3 (not shown). We use the Lerner index in Panel A and the net interest margin in Panel B as dependent variable. Country and year dummies included. Standard errors clustered on the country level unless stated otherwise. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Lerner index									**Panel B: Net interest margins**							
Subpanel: Clustering and additional controls	*Clustering of SE by year*				*Controlling for asset management and restructuring companies*				*Clustering of SE by year*				*Controlling for asset management and restructuring companies*			
Blanket guarantee	-0.025				-0.027				-0.014**				-0.014			
	(-1.04)				(-1.12)				(-2.30)				(-0.56)			
Liquidity support		-0.033**				-0.033*				-0.028				-0.027*		
		(-2.28)				(-1.95)				(-1.60)				(-1.78)		
Recapitalizations			-0.039***				-0.038**				-0.034**				-0.031**	
			(-3.38)				(-2.14)				(-2.64)				(-2.08)	
Nationalizations				-0.001				-0.002				-0.039**				-0.038**
				(-0.08)				(-0.08)				(-2.55)				(-2.07)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687
R2	0.242	0.243	0.244	0.241	0.241	0.243	0.244	0.241	0.661	0.663	0.664	0.665	0.664	0.666	0.667	0.668
Number of interventions	11	34	32	26	11	34	32	26	11	34	32	26	11	34	32	26
Subpanel: TBTF and TMTF	*Accounting for the too-big-to-fail effect (TBTF)*				*Accounting for the too-many-to-fail effect (TMTF)*				*Accounting for the too-big-to-fail effect (TBTF)*				*Accounting for the too-many-to-fail effect (TMTF)*			
Blanket guarantee	-0.025				-0.009				-0.015				-0.006			
	(-1.00)				(-0.34)				(-0.60)				(-0.23)			
Liquidity support		-0.035**				-0.028*				-0.029*				-0.027		
		(-2.04)				(-1.81)				(-1.91)				(-1.59)		
Recapitalizations			-0.040**				-0.034**				-0.035**				-0.033*	
			(-2.18)				(-2.18)				(-2.27)				(-1.79)	
Nationalizations				-0.002				-0.039**				-0.040**				0.007
				(-0.12)				(-2.08)				(-2.17)				(0.38)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610
R2	0.235	0.237	0.237	0.234	0.671	0.674	0.675	0.676	0.655	0.658	0.659	0.660	0.248	0.250	0.250	0.248
Number of interventions	11	34	32	26	10	33	31	25	11	34	32	26	10	33	31	25
Subpanel: Subsamples	*High income economies excluded*				*Emerging market economies excluded*				*High income economies excluded*				*Emerging market economies excluded*			
Blanket guarantee	-0.087**				-0.016				-0.032				-0.041***			
	(-2.29)				(-0.46)				(-0.97)				(-3.08)			
Liquidity support		-0.049				-0.042**				-0.047**				-0.033*		
		(-1.51)				(-2.08)				(-2.04)				(-1.95)		
Recapitalizations			-0.061*				-0.044*				-0.048**				-0.048***	
			(-1.89)				(-1.95)				(-2.47)				(-2.63)	
Nationalizations				-0.027				-0.005				-0.070***				-0.047**
				(-0.69)				(-0.21)				(-2.67)				(-2.40)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1223	1223	1223	1223	1381	1381	1381	1381	1223	1223	1223	1223	1381	1381	1381	1381
R2	0.257	0.258	0.259	0.256	0.246	0.249	0.249	0.246	0.672	0.676	0.675	0.678	0.657	0.660	0.663	0.662
Number of interventions	7	21	20	17	6	24	22	17	7	21	20	17	6	24	22	17
Subpanel: Weights,accounting for onset of crises	*Weighted regressions*				*Controlling for onset of crises*				*Weighted regressions*				*Controlling for onset of crises*			
Blanket guarantee	-0.025				-0.025				-0.024				-0.013			
	(-1.01)				(-1.04)				(-0.97)				(-0.54)			
Liquidity support		-0.030*				-0.033*				-0.028*				-0.030*		
		(-1.88)				(-1.92)				(-1.79)				(-1.94)		
Recapitalizations			-0.042**				-0.039**				-0.040**				-0.034**	
			(-2.28)				(-2.11)				(-2.47)				(-2.22)	
Nationalizations				0.001				-0.001				-0.046**				-0.039**
				(0.04)				(-0.04)				(-2.31)				(-2.12)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687
R2	0.247	0.247	0.248	0.247	0.242	0.243	0.244	0.241	0.666	0.667	0.668	0.668	0.661	0.664	0.665	0.665
Number of interventions	11	34	32	26	11	34	32	26	11	34	32	26	11	34	32	26

Supplementary Appendix Table A.7
Competition measurement: Panzar and Rosse (1987) H-Statistic as dependent variable

This table presents an additional test that rules out that competition measurement drives our inferences. We use the Panzar and Rosse (1987) H-Statistic as an alternative competition measure. The explanatory variables in these regressions are identical to the ones used in the analyses shown in Table 3. Unlike the Lerner index and the net interest margin, the H-Statistic increases in competition. The H-Statistic measures the effect of revenue elasticities with respect to factor input prices and is a measure of contestability. The control variables (not shown for brevity) are an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Dependent variable	*H-Statistic*	*H-Statistic*	*H-Statistic*	*H-Statistic*
Blanket guarantee	0.042*			
	(1.79)			
Liquidity support		0.018		
		(0.97)		
Recapitalizations			0.031*	
			(1.79)	
Nationalizations				0.037**
				(2.08)
Control variables	Yes	Yes	Yes	Yes
Observations	1,538	1,538	1,538	1,538
R2	0.836	0.836	0.837	0.837
Number of interventions	11	33	31	25

Supplementary Appendix Table A.8
Initial market conditions and the role of transparency

Panel A examines initial conditions. We present coefficients from difference-in-difference regressions of the effect of the interactions of blanket guarantees, liquidity support, recapitalizations, and nationalizations with initial conditions of concentration, foreign bank ownership, activity restrictions, entry restrictions, and explicit deposit insurance on competition. Each cell represents a single regression. All other coefficients are suppressed to preserve space. All regressions include the control variables discussed in the notes to Table 3. Since the difference-in-difference estimator requires a control group for which the initial conditions have to be defined, we use a 1:*n* matching procedure that matches a country that recorded any one of these government interventions with a group of comparable countries based on year and World Bank income category. Panel B tests the effect of transparency by interacting a Transparency index with the four different government interventions. We use a Transparency index which consists of a dummy variable that takes on the value one if a compulsory external audit is required and an accounting index that is increasing in the quality of bank accounts. Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: The role of initial conditions

Subpanel: Lerner index	*Market structure*	*Contestability*	*Contestability*	*Contestability*	*Moral hazard*
Government intervention interacted with	*Concentration HHI (initial conditions)*	*Foreign bank ownership (initial conditions)*	*Activity restrictions index (initial conditions)*	*Entry restrictions index (initial conditions)*	*Explicit deposit insurance (initial conditions)*
Blanket guarantee × Column variable	-0.327***	0.115***	-0.004	-0.051***	0.069
	(-7.74)	(2.92)	(-0.38)	(-3.34)	(0.64)
Liquidity support × Column variable	-0.194***	0.126**	-0.003	-0.024	0.049
	(-2.75)	(2.10)	(-0.36)	(-1.65)	(1.14)
Recapitalizations × Column variable	-0.261***	0.131**	-0.009	-0.030**	0.064
	(-4.33)	(2.09)	(-1.22)	(-2.09)	(1.52)
Nationalizations × Column variable	-0.231**	0.144**	-0.000	-0.027*	0.077*
	(-2.34)	(2.07)	(-0.01)	(-1.76)	(1.77)
Subpanel: Net interest margin					
Blanket guarantee × Column variable	-0.061	-0.008	0.030***	0.009	0.020
	(-0.75)	(-0.18)	(3.06)	(0.63)	(0.52)
Liquidity support × Column variable	-0.043	-0.033	0.012	0.008	0.112***
	(-0.71)	(-0.70)	(1.40)	(1.48)	(2.82)
Recapitalizations × Column variable	-0.060	-0.023	0.002	0.004	0.122***
	(-0.95)	(-0.48)	(0.16)	(0.65)	(3.52)
Nationalizations × Column variable	-0.080	-0.039	0.017*	0.005	0.110**
	(-1.17)	(-0.56)	(1.77)	(1.01)	(2.68)

Panel B: The role of transparency

Subpanel: Lerner index					**Subpanel: Net interest margin**			
Transparency index	-0.010	-0.013	-0.011	-0.013	-0.006	-0.008*	-0.007*	-0.008*
	(-1.02)	(-1.24)	(-1.16)	(-1.27)	(-1.46)	(-1.94)	(-1.70)	(-1.89)
Blanket guarantee	-0.215				-0.134**			
	(-0.99)				(-2.43)			
Blanket guarantee × Transparency	0.045				0.026**			
	(0.89)				(2.19)			
Liquidity support		-0.175**				-0.135**		
		(-2.15)				(-2.46)		
Liquidity support × Transparency		0.036**				0.028***		
		(2.08)				(2.83)		
Recapitalizations			-0.222**				-0.113*	
			(-2.20)				(-1.84)	
Recapitalizations × Transparency			0.042*				0.023*	
			(1.80)				(1.81)	
Nationalizations				-0.188**				-0.152***
				(-2.08)				(-3.16)
Nationalizations × Transparency				0.044**				0.030***
				(2.16)				(3.44)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1142	1142	1142	1142	1142	1142	1142	1142
R2	0.320	0.321	0.323	0.322	0.724	0.726	0.725	0.726
Number of interventions	9	26	25	21	9	26	25	21

Supplementary Appendix Table A.9
The role of bank charter values

This table presents difference-in-difference regressions for the effect of blanket guarantees, liquidity support, recapitalizations, and nationalizations on banking competition, measured by the Lerner index in Panel A and the net interest margin in Panel B. These regressions additionally consider the role of bank charter values, interacted with the government interventions. We approximate bank charter values by the ratio of current deposits to total deposits and real money market and short-term funding. The control variables (not shown for brevity) are an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Lerner index					**Panel B: Net interest margin**			
Charter value	0.004	0.009	0.006	0.004	0.033	0.026	0.030	0.029
	(0.14)	(0.30)	(0.22)	(0.14)	(1.61)	(1.29)	(1.42)	(1.41)
Blanket guarantee	-0.003				-0.030			
	(-0.07)				(-1.30)			
Blanket guarantee × Charter value	-0.042				-0.016			
	(-0.40)				(-0.46)			
Liquidity support		-0.008				-0.042**		
		(-0.29)				(-2.05)		
Liquidity support × Charter value		-0.061				0.040		
		(-0.98)				(1.22)		
Recapitalizations			-0.020				-0.037**	
			(-0.69)				(-2.07)	
Recapitalizations × Charter value			-0.046				0.008	
			(-0.74)				(0.26)	
Nationalizations				0.016				-0.045**
				(0.61)				(-2.20)
Nationalizations × Charter value				-0.029				0.016
				(-0.47)				(0.52)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1600	1600	1600	1600	1600	1600	1600	1600
R2	0.253	0.255	0.255	0.253	0.663	0.665	0.665	0.666
Number of interventions	10	32	30	24	10	32	30	24

Supplementary Appendix Table A.10
Effects of government interventions on the components of the Lerner index (prices and marginal cost)

This table presents difference-in-difference regressions with the components of the Lerner index, prices in Panel A and marginal cost in Panel B as dependent variables. Marginal costs are obtained by differentiating the Translog cost function shown in Supplementary Appendix A.3. The control variables (not shown for brevity) are an asset-based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a dummy that takes on the value of one if assisted mergers took place, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, GDP growth, inflation, real GDP per capita, real money market rates (ln) as a proxy for monetary policy, the ratio of government debt to GDP, and the change of the exchange rate (in local currency units per USD). Country and year dummies included. Standard errors are clustered on the country level. Robust *t*-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Panel A: Lerner index components - Prices					**Panel B: Lerner index components - Marginal cost**			
Blanket guarantee	-0.027*				-0.025*			
	(-1.72)				(-1.88)			
Liquidity support		-0.017**				-0.014**		
		(-2.39)				(-2.12)		
Recapitalizations			-0.013				-0.013	
			(-1.47)				(-1.49)	
Nationalizations				-0.019**				-0.019**
				(-2.27)				(-2.55)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687	1687	1687	1687	1687
R2	0.744	0.745	0.743	0.744	0.738	0.738	0.737	0.739
Number of interventions	11	34	32	26	11	34	32	26